
REVISION OF THE NORTH AMERICAN SPECIES OF *GRINDELIA* (ASTERACEAE)¹

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ABSTRACT

A revision of North American species of the genus *Grindelia* Willd. (Asteraceae) was carried out. Forty-one species, 10 varieties, and two forms are recognized, and a key is given. The following new combinations are made: *G. fastigiata* Greene var. *revoluta* (Steyerm.) Adr. Bartoli & Tortosa [= *G. revoluta* Steyerm.], *G. hirtella* (B. L. Rob. & Greenm.) Adr. Bartoli & Tortosa [= *G. squarrosa* (Pursh) Dunal var. *hirtella* B. L. Rob. & Greenm.], *G. humilis* Hook. & Arn. var. *platyphylla* (Greene) Adr. Bartoli & Tortosa [= *G. robusta* Nutt. var. *platyphylla* Greene], *G. lanceolata* Nutt. var. *subincisa* (Greene) Adr. Bartoli & Tortosa [= *G. subincisa* Greene], *G. leptocarpa* (De Jong & Beaman) Adr. Bartoli & Tortosa [= *Olivaea leptocarpa* De Jong & Beaman], *G. squarrosa* f. *pseudopinnatifida* (D. Löve & J.-P. Bernard) Adr. Bartoli & Tortosa [= *G. perennis* A. Nelson f. *pseudopinnatifida* D. Löve & J.-P. Bernard], *G. squarrosa* var. *eligulata* (Steyerm.) Adr. Bartoli & Tortosa [= *G. oxylepis* Greene var. *eligulata* Steyerm.], and *G. tricuspis* (Sch. Bip.) Adr. Bartoli & Tortosa [= *O. tricuspis* Sch. Bip.]. *Aster glutinosus* Cav. is proposed as lectotype for the genus *Demetria* Lag. and a neotype is designated for *D. spathulata* Lag. The following names are lectotypified: *G. inuloides* Willd., *G. lanceolata*, *G. nana* Nutt., *G. nana* var. *integrifolia* Nutt., *G. platylepis* Greene, *G. subincisa* [= *G. lanceolata* var. *subincisa*], and *G. texana* Scheele [= *G. lanceolata* var. *texana* (Scheele) Shinnery]. Seventeen taxa are illustrated for the first time.

RESUMEN

Se lleva a cabo una revisión de las especies norteamericanas del género *Grindelia* Willd. (Asteraceae). Se reconocen 41 especies, 10 variedades y dos formas y se incluye una clave para su determinación. Se realizan las siguientes nuevas combinaciones: *G. fastigiata* Greene var. *revoluta* (Steyerm.) Adr. Bartoli & Tortosa [= *G. revoluta* Steyerm.], *G. hirtella* (B. L. Rob. & Greenm.) Adr. Bartoli & Tortosa [= *G. squarrosa* (Pursh) Dunal var. *hirtella* B. L. Rob. & Greenm.], *G. humilis* Hook. & Arn. var. *platyphylla* (Greene) Adr. Bartoli & Tortosa [= *G. robusta* Nutt. var. *platyphylla* Greene], *G. lanceolata* Nutt. var. *subincisa* (Greene) Adr. Bartoli & Tortosa [= *G. subincisa* Greene], *G. leptocarpa* (De Jong & Beaman) Adr. Bartoli & Tortosa [= *Olivaea leptocarpa* De Jong & Beaman], *G. squarrosa* f. *pseudopinnatifida* (D. Löve & J.-P. Bernard) Adr. Bartoli & Tortosa [= *G. perennis* A. Nelson f. *pseudopinnatifida* D. Löve & J.-P. Bernard], *G. squarrosa* var. *eligulata* (Steyerm.) Adr. Bartoli & Tortosa [= *G. oxylepis* Greene var. *eligulata* Steyerm.] y *G. tricuspis* (Sch. Bip.) Adr. Bartoli & Tortosa [= *O. tricuspis* Sch. Bip.]. Se propone *Aster glutinosus* Cav. como lectotipo del género *Demetria* Lag. y se designa un neotipo para *D. spathulata* Lag. Los siguientes nombres son lectotipificados: *G. inuloides* Willd., *G. lanceolata*, *G. nana* Nutt., *G. nana* var. *integrifolia* Nutt., *G. platylepis* Greene, *G. subincisa* [= *G. lanceolata* var. *subincisa*] y *G. texana* Scheele [= *G. lanceolata* var. *texana* (Scheele) Shinnery]. Se ilustran por primera vez 17 taxa.

Key words: Asteraceae, *Grindelia*, North America.

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This paper treats the species of *Grindelia* Willd. of North America. *Grindelia* is a New World genus of Asteraceae and a member of the tribe Astereae, subtribe Solidagininae, with a disjunct distribution in North America and austral South America. In South America, the genus occurs in Peru, Chile, Bolivia, Brazil, Argentina, and Uruguay, and has been taxonomically treated by Cabrera (1931), Bartoli and Tortosa (1999, 2003), and Granda Paucar et al. (2000). The boreal species of *Grindelia* that inhabit Canada, the United States, and Mexico were monographed by Steyermark (1934), who recognized 45 species, 40 varieties, and 25 forms. Subsequently, partial treatments have been done by Reveal and Beatley (1971), Nesom (1990, 1992), Lane (1992, 1993), and Strother and Wetter (2006), who introduced new taxa, nomenclatural changes, and new taxonomic interpretations. Further, Nesom has made available to the authors his unpublished manuscript for Mexican *Grindelia*. Nesom et al. (1993) included the monotypic genus *Prionopsis* Nutt. within *Grindelia*, which was followed by Strother and Wetter (2006) but not by Lane and Hartman (1996).

We agree with Lane and Hartman (1996) that *Prionopsis* is a different genus from *Grindelia* because of its pappus with persistent awns, absence of glands on the abaxial surface of phyllaries, and costate achenes.

Lane (1992, 1993) hypothesized the existence of hybrids between different species of *Grindelia*, but no research was done to prove this assumption.

TAXONOMIC TREATMENT

Grindelia Willd., Mag. Neuesten Entdeck. Gesammten Naturk. Ges. Naturf. Freunde Berlin 1: 259. 1807. TYPE: *Grindelia inuloides* Willd.

Donia R. Br., Hortus Kew. (W. T. Aiton), ed. 2, 5: 82. 1813, non *Donia* G. Don & D. Don ex G. Don, 1832 (Fabaceae). *Doniana* Raf., Amer. Monthly Mag. & Crit. Rev. 2: 268. 1818, nom. illeg. superfl. TYPE: *Aster glutinosus* Cav. [= *Donia glutinosa* (Cav.) R. Br.].

Aurelia Cass., Bull. Sci. Soc. Philom. Paris, 175. 1815, nom. illeg. superfl. TYPE: *Aster glutinosus* Cav. [= *Aurelia glutinosa* (Cav.) Cass.].

Demetria Lag., Gen. Sp. Pl. [Lagasca]: 30. 1816, nom. illeg. superfl. (lectotype, designated here, *Aster glutinosus* Cav. [= *Demetria glutinosa* (Cav.) Lag.]).

Hoorebekia Cornel., Hort. Gand. 13–14. 1817. TYPE: *Hoorebekia chiloensis* Cornel. [= *Grindelia chiloensis* (Cornel.) Cabrera].

Olivaea Sch. Bip. ex Benth., Hooker's Icon. Pl. 12: 2–3, tab. 1103. 1876. TYPE: *Olivaea tricuspis* Sch. Bip. [= *Grindelia tricuspis* (Sch. Bip.) Adr. Bartoli & Tortosa].

Golionema S. Watson, Bot. Gaz. 16: 267. 1891. Replaced name: *Oligonema* S. Watson, Proc. Amer. Acad. Arts 26: 138. 1891, nom. illeg. superfl., non *Oligonema*

Rostaf., Monogr., 291. 1875 (Myxomycete, Trichiaceae). TYPE: *Golionema heterophyllum* (S. Watson) S. Watson (epithet ending corrected by S. Watson, 1891, to neuter ending, cf. Art. 62.2c.). [= *Grindelia tricuspis* (Sch. Bip.) Adr. Bartoli & Tortosa].

Annual or perennial, herbs, subshrubs, or shrubs; indumentum of simple hairs, stipitate glandular trichomes, and/or sessile glandular trichomes on stems, leaves, and phyllaries. Leaves alternate, sessile or petiolate, entire to pinnatisect, margin entire to toothed, teeth blunt or ending in a group of sessile glandular trichomes or in a sclerotic tip, sometimes spinulose. Heads solitary or grouped, radiate or discoid; involucre hemispheric or hemispheric-campanulate; phyllaries in 4 to 8 series, subequal to abruptly graduated, free or $\pm$ connate, usually with a sclerified portion; receptacle pitted, epaleate, glabrous. Ray florets pistillate, corolla yellow, entire, lobed or toothed; tube usually glabrous, rarely stipitate glandular trichomes; style with branches linear-elliptic, apex obtuse, glabrous. Disk florets perfect, tubular, limb 5-toothed; tube usually glabrous, rarely stipitate glandular trichomes; anthers shortly sagittate at the base, apex of connective ovate to ovate-elliptic; style branches in disk florets flattened, elliptic, acute, with sweeping papillose trichomes on the outer side. Achenes flattened or prismatic, sometimes winged, glabrous; pappus 2 to 5 scales or setiform awns, or 2 to 80 bristles, white, deciduous. Chromosome number: $x = 6$ (Whitaker & Steyermark, 1935: 71; Powell & Turner, 1963: 130).

Discussion. When Lagasca (1816) described *Demetria* as a new genus, he included two species, *D. spathulata* Lag. from Mexico, and *D. glutinosa*, a South American species. We choose *D. glutinosa* as lectotype for the genus, for which there is a type and a plate (Cavanilles, 1793: pl. 168) available.

Several of the genus-level synonyms for *Grindelia* are typified by *Aster glutinosus*, a species from Peru (cf. Cavanilles, 1798; McVaugh, 2000: 137).

Aster glutinosus Cav., Icon. 2(2): 53–54, tab. 168. 1793. *Donia glutinosa* (Cav.) R. Br., Hortus Kew. (W. T. Aiton), ed. 2, 5: 82. 1813. *Grindelia glutinosa* (Cav.) Mart., Pl. Hort. Acad. Erlang., 182. 1814. *Aurelia glutinosa* (Cav.) Cass., Bull. Sci. Soc. Philom. Paris, 175. 1815. *Demetria glutinosa* (Cav.) Lag., Gen. Sp. Pl. [Lagasca], 30. 1816. *Grindelia glutinosa* (Cav.) Dunal, Mém. Mus. Hist. Nat. 5: 49. 1819, nom. illeg. superfl. TYPE: “Mexico” [flowered at the Royal Botanical Garden of Madrid in December (1792 or earlier)], “*Aster glutinosus* sp. nov.,” s.d., s. coll.

s.n. (lectotype, designated here, US-00145634 ex BM digital image!).

Cavanilles's type was not found at MA, but there is a specimen at US annotated from Mexico, as *s. coll.*, "Aster glutinosus sp. nov." (US-00145634 ex BM) that was annotated by Steyermark (1 Mar. 1933) as "part of type collection of *Aster glutinosus* Cav.," and that fits the protologue. We designate this specimen here as lectotype of *A. glutinosus*.

DIAGNOSTIC CHARACTERS FOR THE NORTH AMERICAN SPECIES OF *GRINDELIA*

Grindelia consists of annual plants with subligneous floriferous stems such as *G. adenodonta* (Steyerm.) G. L. Nesom (*Palmer 10134*, MO), *G. confusa* Steyerm. (*Correll & Johnston 20165*, TEX), and *G. grandiflora* Hook. (*Cory 52450*, PH), or of perennial plants with floriferous stems that arise from a rhizome (*G. greenmanii* Steyerm., *Mueller 2173*, MO; *G. leptocarpa* (De Jong & Beaman) Adr. Bartoli & Tortosa, *Worthington 8963*, NY; *G. obovatifolia* S. F. Blake, *Nesom & Morgan 6789*, MO), a lignotuber (*G. turneri* G. L. Nesom, *Hinton 22268*, TEX), or a rosette of leaves (*G. camporum* Greene, *Howell 10827*, MO) that originates proleptically from renewals at the base of stems from the previous year. Two aquatic taxa, *G. leptocarpa* and *G. tricusps*, have noteworthy fistulose stems.

Leaves in *Grindelia* may be succulent, subcoriaceous, or herbaceous; sessile or with blades that are attenuate into the pseudopetiole; entire, lobed, or pinnatisect. The blades may range from linear, elliptic, oblong, ovate, obovate, spatulate, to somewhat triangular, or fiddle-shaped. Blade bases may be cuneate, cordate, or clasping, and sometimes auriculate; blade apices may be acute, acuminate, rounded, obtuse, or mucronate. Leaf margins may be crenate, denticulate, serrate, toothed, and sometimes scabrous. Marginal teeth (Fig. 1) may be dull, ending in a group of sessile glandular trichomes, as in *G. adenodonta* (Wetter 605, NY), *G. squarrosa* (Pursh) Dunal (*Engelmann 650*, MO), and *G. turneri* (*Hinton 22268*, TEX), or in a sclerotic tip as in *G. arizonica* A. Gray (*Baker 682*, GH) and *G. camporum* (*Howell 10827*, MO), or in a spinule as in *G. lanceolata* Nutt. (*Bush 220*, MO).

Heads in *Grindelia* may be radiate or discoid, solitary, and sessile to pedunculate. The involucre may be hemispheric to urceolate or campanulate, and sometimes broadly urceolate or obconic. Phyllaries are disposed in four to eight series, subequal or graduated; filiform, linear, elliptic, ovate, or obovate, subulate (gradually tapering to the apex) or acumi-

nate (tapering to the apex into a narrow or slender point), with the margin entire or scabrous; erect, spreading, curved, revolute, or reflexed. The phyllary base is usually sclerified; when subulate the apex may be acute, mucronate, or spinulose, terete to flattened, with straight to curved tips; when acuminate, the acumen may be shorter than, equal to, or longer than the base, filiform, linear, triangular, or ovate, flattened to terete, erect to reflexed.

Indumentum in *Grindelia* includes simple hairs, stipitate glandular trichomes, and sessile glandular trichomes that occur frequently in pits.

Ray florets in *Grindelia* range from 12 to 60 per head, with the corolla tube glabrous or with stipitate glandular trichomes. The ray ligule may be narrowly linear to elliptic, oblong or ovate, with the apex entire, lobed, or toothed. Disk florets are numerous, and the corolla may have a gradually or abruptly ampliate throat.

Achenes in *Grindelia* may be yellowish to dull brown, light brown to stramineous or dark brown, 2- to 4-angled, prismatic or flattened, elliptic to globose or subquadrate to quadrate, sometimes obconic, and occasionally winged. The achene surface may be smooth, rugose, striate, barely tuberculate to tuberculate, or with deep furrows or shallow incisions, with the achene apex rounded, truncate, with one or two teeth or knobby, or forming a crown. The pappus is caducous and varies from two to five subulate scales (greatest width ca. three times the radial thickness) to setiform awns (greatest width ca. two times the radial thickness), or bristles (width about equal to radial thickness) that are smooth to barbellate (sensu Strother & Wetter, 2006).

Gametophytic chromosome numbers have been consistently reported as $n = 6$: Chambers et al., 1998 (*Grindelia integrifolia* DC.); De Jong and Beaman, 1963 (*G. leptocarpa* and *G. tricusps*); Dunford, 1986 (*G. arizonica*, *G. camporum*, *G. fastigiata* Greene var. *fastigiata*, *G. fastigiata* var. *revoluta* (Steyerm.) Adr. Bartoli & Tortosa, *G. grandiflora*, *G. havardii* Steyerm., *G. lanceolata* var. *lanceolata*, *G. lanceolata* var. *texana* (Scheele) Shinnars, *G. nana* Nutt. var. *nana*, and *G. subalpina* Greene); Lane and Li, 1993 (*G. camporum*, *G. confusa*, *G. hallii* Steyerm., and *G. squarrosa*); Pinkava and Keil, 1977 (*G. arizonica*, *G. grandiflora*, *G. greenmanii*, and *G. squarrosa* f. *squarrosa*); Powell and Turner, 1963 (*G. inuloides*, *G. pusilla* (Steyerm.) G. L. Nesom, and *G. robinsonii* Steyerm.); Raven et al., 1960 (*G. hallii*); Semple et al., 1989 (*G. inuloides*). Sporophytic chromosome counts have been reported as $2n = 12$: Cronquist, 1994 (*G. fastigiata*, *G. laciniata* Rydb., *G. nana*, *G.*

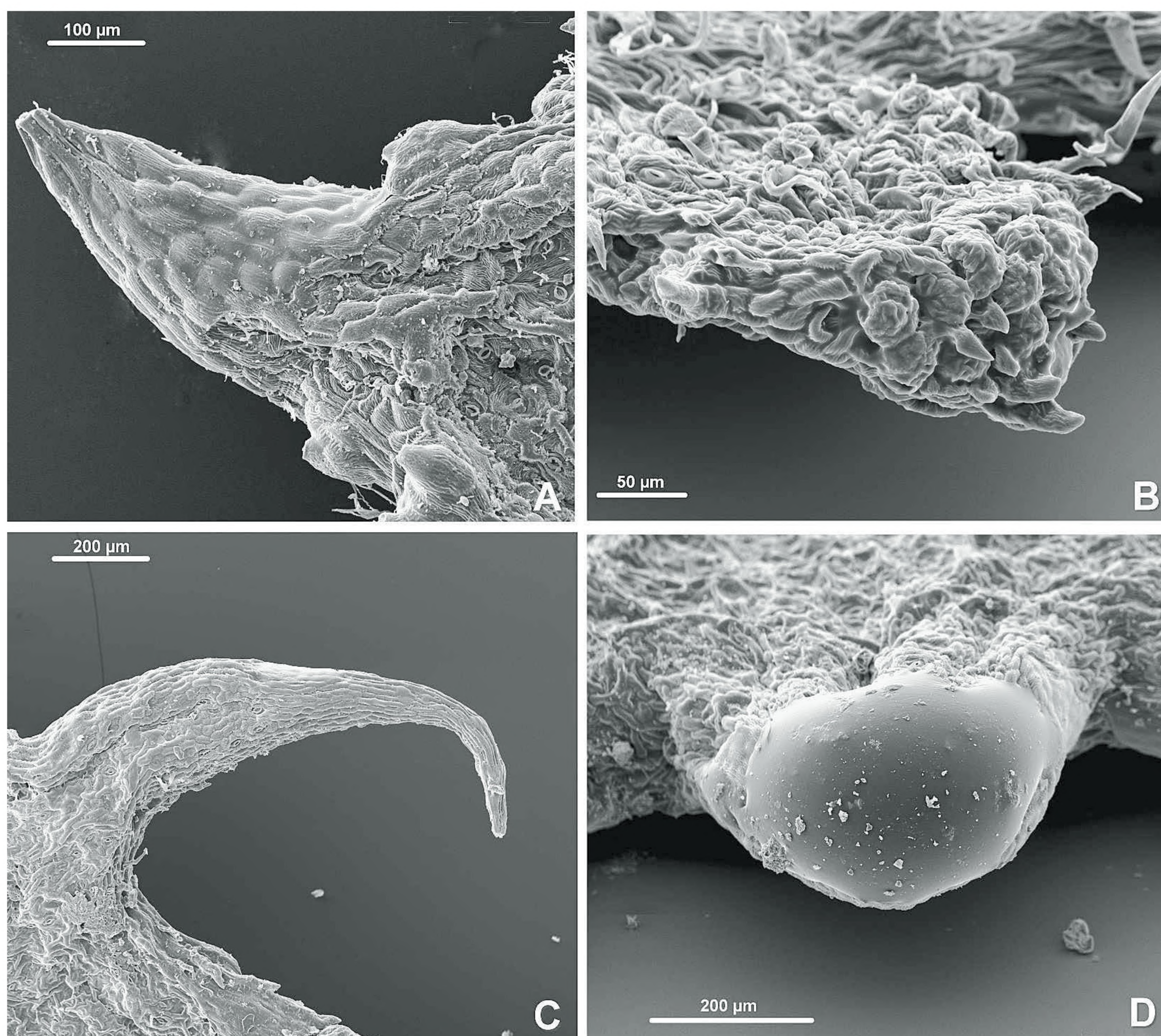


Figure 1. Marginal teeth of the leaves of *Grindelia* Willd. —A. Leaf tooth ending in a sclerotic tip. Micrograph from *G. camporum* Greene, *M. A. Lane* 3098 (PH). —B. Leaf tooth ending in a group of sessile glandular trichomes. Micrograph from *G. turneri* G. L. Nesom, *G. B. Hinton* 17760 (TEX). —C. Leaf tooth ending in a spinule. Micrograph from *G. lanceolata* Nutt., *M. A. Wetter* 485 (SI). —D. Micrograph corresponds to B, but the tooth surface is covered by resins secreted by the glandular trichomes.

nana var. *discoidea* (Nutt.) A. Gray, and *G. squarrosa*); Dunford, 1964 (*G. camporum*); Dunford, 1969 (*G. grandiflora*, *G. lanceolata* var. *texana*, *G. microcephala* DC., and *G. oolepis* S. F. Blake); Lane, 1993 (*G. hirsutula* Hook. & Arn. and *G. humilis* Hook. & Arn.); Lane and Li, 1993 (*G. humilis*); McLaughlin, 1986 (*G. camporum*); Morton, 1981 (*G. nana* and *G. squarrosa*); Pinkava and Keil, 1977 (*G. grandiflora* and *G. humilis*); Powell and Turner, 1963 (*G. oxylepis* Greene, *G. oxylepis* var. *eligulata* Steyerl., and *G. squarrosa* var. *eligulata* (Steyerl.) Adr. Bartoli & Tortosa); Powell and Powell, 1978 (*G. havardii*); Pinkava and Keil, 1977 (*G. squarrosa* var. *eligulata* and *G. squarrosa* var. *nuda* (Alph. Wood) A. Gray); Raven et al., 1960 (*G. hallii*, *G. hirsutula*, *G. humilis*, *G. squarrosa*, and *G. squarrosa* var. *nuda*);

Semple et al., 1989 (*G. humilis* and *G. oxylepis*); Semple et al., 1992 (*G. camporum*); Whitaker and Steyerl., 1935 (*G. camporum*, *G. columbiana* (Piper) Rydb., *G. decumbens* Greene, *G. lanceolata*, *G. nana*, and *G. perennis* A. Nelson); Zhao, 1996 (*G. obovatifolia* and *G. tenella* Steyerl.); Zhao and Turner, 1993 (*G. grandiflora* and *G. pusilla*). Mitotic chromosome counts also include $2n = 24$: Dunford, 1964 (*G. camporum*, *G. hirsutula*, and *G. stricta* DC.); Dunford, 1969 (*G. lanceolata*); Lane, 1993 (*G. fraxinipratensis* Reveal & Beatley, *G. humilis*, and *G. humilis* var. *platyphylla* (Greene) Adr. Bartoli & Tortosa); McLaughlin, 1986 (*G. camporum*); Morton, 1981 (*G. integrifolia*); Semple et al., 1989 (*G. subdecurrens* DC.); Whitaker and Steyerl., 1935 (*G. camporum*, *G. hirsutula* var. *brevisquama*

Steyerm., *G. humilis*, *G. maritima* (Greene) Steyerm., var. *platyphylla* (Greene) Steyerm., and *G. squarrosa*
G. rubricaulis DC. var. *elata* Steyerm., *G. rubricaulis* var. *nuda*).

TAXONOMIC KEY TO NORTH AMERICAN SPECIES OF *GRINDELIA*

1a.	Aquatic plants; stems fistulose	2
1b.	Terrestrial plants; stems not fistulose	3
2a.	Stems 1 or 2, scarcely ramified; heads 2–3 cm diam.; involucre 4–7 × 10–15 mm; achenes 2-angled; pappus 2 to 5 bristles	20. <i>G. leptocarpa</i>
2b.	Stems several, ramified; heads 3–4 cm diam.; involucre 10–15 × 15–20 mm; achenes 2- or 3-winged; pappus 5 to 12 bristles	39. <i>G. tricuspis</i>
3a.	Phyllaries in subequal series	4
3b.	Phyllaries in graduated or strongly graduated series	15
4a.	Phyllaries subulate	5
4b.	Phyllaries acuminate	8
5a.	Perennial subshrubs with xylopodium; stems prostrate	12. <i>G. hintoniorum</i>
5b.	Annual subshrubs; stems erect	6
6a.	Plants 0.08–0.15 m; achenes sharply cut with transverse furrows	31. <i>G. pusilla</i>
6b.	Plants 0.25–1.3 m; achenes smooth, rugose, or striate	7
7a.	Leaves with sessile glandular trichomes, not in pits, and stipitate trichomes; achenes obconic, the inner flattened; pappus of 2 subulate scales	1. <i>G. adenodonta</i>
7b.	Leaves with sessile glandular trichomes in pits; achenes globose; pappus of 2 or 3 setiform awns	22. <i>G. microcephala</i>
8a.	Leaves with teeth ending in a sclerotic tip or a curved spinule	9
8b.	Leaves with teeth ending in a group of sessile glandular trichomes	13
9a.	Teeth ending in a curved spinule	19. <i>G. lanceolata</i>
9b.	Teeth ending in a sclerotic tip	10
10a.	Phyllaries with margin scabrous; acumen filiform, terete or subterete	33. <i>G. scabra</i>
10b.	Phyllaries with margin entire; acumen linear, triangular, elliptic, or narrowly ovate, flat or subterete	11
11a.	Phyllary acumen linear-elliptic to narrowly ovate; pappus of 2 bristles	17. <i>G. inuloides</i>
11b.	Phyllary acumen triangular	12
12a.	Plants rhizomatous; acumen shorter than the base; pappus of 2 or 3 bristles	9. <i>G. greenmanii</i>
12b.	Plants not rhizomatous; acumen as long as the base; pappus of 2 to 5 curved, subulate scales	15. <i>G. humilis</i>
13a.	Plants with xylopodium; stems prostrate with tips rising upward, not or few ramified; heads 1.4–2 cm diam.; pappus of 2 setiform awns	40. <i>G. turneri</i>
13b.	Plants without xylopodium; stems ascendent or erect, ramified; heads 3–5 cm diam.; pappus of 2 or 3 bristles ...	14
14a.	Outer phyllaries with acumen very long and narrow; achenes subquadrate, smooth or longitudinally striate with shallow transverse incisions at apex	24. <i>G. nelsonii</i>
14b.	Outer phyllaries with acumen equal to or shorter than base; achenes elliptic, 2- or 3-angled, smooth or slightly rugose	29. <i>G. palmeri</i>
15a.	Phyllaries acuminate	16
15b.	Phyllaries subulate	36
16a.	Leaves with sessile glandular trichomes in pits	17
16b.	Leaves with sessile glandular trichomes not in pits	23
17a.	Leaves with teeth ending in a group of glandular trichomes	18
17b.	Leaves with teeth ending in a sclerotic tip	19
18a.	Achenes smooth, rugose, or slightly furrowed; pappus of 2 or 3 curved, setiform awns	34. <i>G. squarrosa</i>
18b.	Achenes with prominent longitudinal furrows; pappus of 2 to 4 straight bristles	36. <i>G. subdecurrens</i>
19a.	Acumen of phyllaries revolute; heads radiate or discoid	20
19b.	Acumen of phyllaries erect or curved, not reflexed or revolute; heads radiate	21
20a.	Heads pedunculate; involucre 7–10 × 7–10 mm; stems several, somewhat decumbent at the base ...	23. <i>G. nana</i>
20b.	Heads sessile or subsessile; involucre 10–14 × 9–17 mm; stems 2 to 4, erect	6. <i>G. fastigiata</i>
21a.	Heads 0.8–1.4 cm diam.; phyllaries with acumen triangular, flat, erect; achenes with a truncate to knobby apex; pappus of 2 bristles	7. <i>G. fraxinipratensis</i>
21b.	Heads 1.5–3 cm diam.	22
22a.	Heads 2–3 cm diam.; phyllaries with acumen terete or subterete, curved; achenes with a crown at the apex; pappus of 2 or 3 subulate scales	3. <i>G. camporum</i>
22b.	Heads 1.5–2 cm diam.; phyllaries with acumen triangular, subterete, erect; achenes with apex truncate; pappus of 2 to 5 setiform awns	5. <i>G. decumbens</i>
23a.	Stipitate glandular trichomes absent	24
23b.	Stipitate glandular trichomes present	30
24a.	Stems prostrate with tips rising upward; heads subsessile	21. <i>G. macvaughii</i>
24b.	Stems erect; heads pedunculate	25
25a.	Rhizomatous, perennial plants	32. <i>G. robinsonii</i>
25b.	Not rhizomatous, annual, biannual, or perennial plants	26
26a.	Heads 1.5–2 cm diam	27

26b. Heads 2–3.8 cm diam 28

27a. Phyllaries spreading or reflexed, with acumen subterete or terete; stems hairy; achenes subquadrate, tuberculate, apex truncate 14. *G. hirtella*

27b. Phyllaries erect, with acumen flat; stems glabrous; achenes elliptic, 4-angled, striate, with a crown at the apex 2. *G. arizonica*

28a. Perennial plants with xylopodium; acumen reflexed or revolute; pappus of 2 to 8 setiform awns .. 35. *G. subalpina*

28b. Annual plants without xylopodium; acumen erect to spreading; pappus of 2 or 3 bristles 29

29a. Leaves with simple hairs absent; acumen of the phyllaries filiform; achenes monomorphic, broadly elliptic, 2- or 3-angled, longitudinally striate or furrowed, apex knobby or forming a crown 8. *G. grandiflora*

29b. Leaves with simple hairs present; acumen of the phyllaries not filiform; achenes dimorphic, subquadrate, strongly furrowed to tuberculate, the innermost flattened with longitudinal superficial nerves, apex truncate 38. *G. tenella*

30a. Leaves pinnatisect; plants ca. 0.15 m 4. *G. confusa*

30b. Leaves not pinnatisect; plants higher than 0.15 m 31

31a. Leaves clasping or auriculate 32

31b. Leaves not clasping nor auriculate 34

32a. Heads pedunculate, 2.5 cm diam.; leaves with stipitate glandular trichomes along the middle nerve, teeth ending in a group of sessile glandular trichomes 11. *G. havardii*

32b. Heads sessile; leaves with stipitate glandular trichomes on both blade surfaces 33

33a. Heads 2.5–3 cm diam.; leaves with apex acute or acuminate, teeth ending in a sclerotic tip; phyllaries with acumen filiform 16. *G. integrifolia*

33b. Heads 1.6–2 cm diam.; leaves with apex obtuse, teeth blunt; phyllaries with acumen flat to subterete 25. *G. oaxacana*

34a. Rhizomatous herbs; basal leaves with blades attenuate into a pseudopetiole as long as the blade 26. *G. obovatifolia*

34b. Not rhizomatous subshrubs or shrubs; leaves all sessile 35

35a. Heads 1–1.5 cm diam.; achenes subquadrate with transverse and sometimes longitudinal furrows; pappus of 4 bristles 37. *G. sublanuginosa*

35b. Heads 2.5–3 cm diam.; achenes elliptic, rugose or striated; pappus of 2 to 5 setiform awns 30. *G. paysonorum*

36a. Leaves with sessile glandular trichomes in pits 37

36b. Leaves with sessile glandular trichomes not in pits 39

37a. Basal and middle cauline leaves pinnatisect; heads 1 cm diam 18. *G. laciniata*

37b. Leaves not pinnatisect; heads 1.5–2 cm diam 38

38a. Leaves narrowly elliptic; involucre hemispheric to hemispheric-campanulate; pappus of 2 bristles; achenes smooth to furrowed 10. *G. hallii*

38b. Leaves oblong or obovate; involucre urceolate; pappus of 2 or 3 setiform awns; achenes tuberculate 28. *G. oxylepis*

39a. Heads discoid; rhizomatous perennial herbs 27. *G. oolepis*

39b. Heads radiate; not rhizomatous perennial subshrubs 40

40a. Heads 1.3–1.5 cm diam.; leaves with minutely stipitate glandular trichomes; achenes barely tuberculate; pappus of 2 setiform awns 41. *G. villarrealii*

40b. Heads 3.5–4 cm diam.; leaves with sessile glandular trichomes; achenes smooth or striate; pappus of 2 to 4 subulate scales 13. *G. hirsutula*

1. *Grindelia adenodonta* (Steyerm.) G. L. Nesom, Phytologia 73: 327. 1992. Basionym: *Grindelia microcephala* DC. var. *adenodonta* Steyerm., Ann. Missouri Bot. Gard. 21: 467. 1934. TYPE: U.S.A. Texas: 39 mi. W of San Felipe, July–Aug. 1844, *F. Lindheimer* 255 (holotype, MO-130145!; isotypes, GH [barcode] 00008432!, PH [barcode] 00047861!, US [barcode] 00127642!). Figure 2.

Grindelia microcephala DC. f. *angustior* Steyerm., Ann. Missouri Bot. Gard. 21: 469. 1934, syn. nov. [described under *Grindelia microcephala* var. *adenodonta*]. TYPE: U.S.A. Texas: Uvalde Co., near Uvalde, 28 Apr. 1928, *E. J. Palmer* 33590 (holotype, MO-945114!; isotypes, LL [barcode] 00373594 digital image!, NY [barcode] 00169616!).

Annual subshrubs, 0.3–1.3 m; stem 1, erect, ramified, hirsute or villous, sometimes lanuginous at

the apex. Leaves sessile, ovate, triangular-ovate, elliptic, or obovate, clasping; blade apex obtuse to acute, margin with rounded teeth ending in a group of sessile glandular trichomes, simple hairs, and often also sessile and stipitate glandular trichomes, on both blade surfaces; basal leaves 4.5–9 × 1.5–3 cm; cauline leaves auriculate, 2–5.5 × 0.6–2.5 cm. Heads radiate, sessile or subsessile, 0.8–1.5 cm diam.; involucre hemispheric, resinous, 8–12 × 10–12 mm; phyllaries in 4 to 6 subequal series, subulate, subcoriaceous, with sessile glandular trichomes at the apex; the outer and middle bracts narrowly ovate, 8–10 mm, erect to spreading, with a flattened, straight to curved tip, 3–5 mm; the upper phyllary narrowly elliptic, 12 mm, erect. Ray florets 20 to 28; tube glabrous, ligule elliptic or ovate, 8–12 mm, apex entire or toothed. Disk florets with corolla 6–7 mm, with a gradually ampliate throat. Achenes yellowish

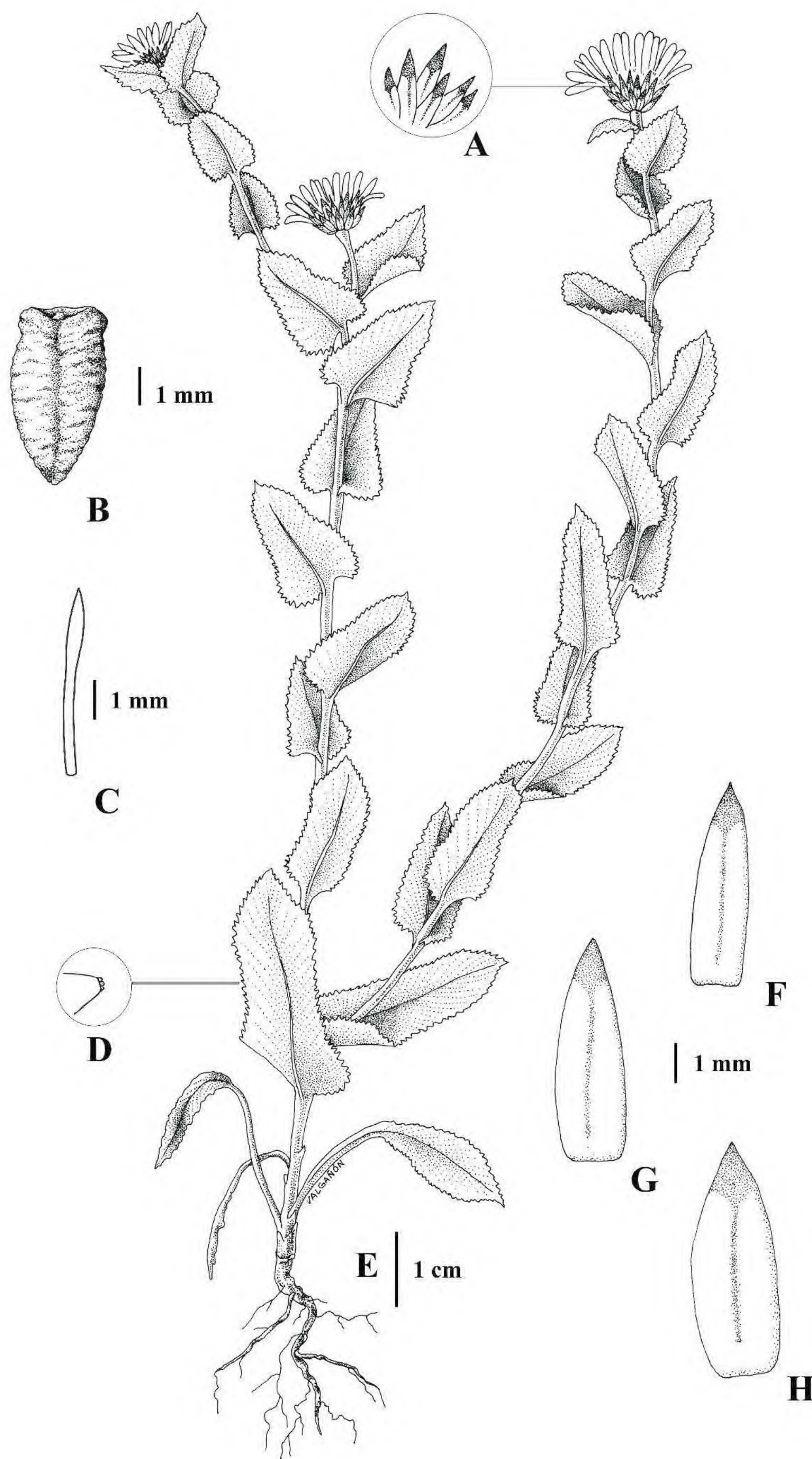


Figure 2. *Grindelia adenodonta* (Steyerm.) G. L. Nesom. —A. Part of the involucre, inner phyllary series represented. —B. Achene, 2- or 3-angled, showing the rugose or striate surface. —C. Pappus, one of the two subulate scales. —D. Leaf tooth, with rounded apex, ending in a group of sessile, glandular trichomes. —E. Fertile habit. F–H. Representative phyllaries. —F. Outer series. —G. Middle series. —H. Inner series. Drawn from A. Ruth 284 (PH).

or dull brown, obconic, 2- or 3-angled, the inner achenes flattened, 3–4.5 mm, rugose or striate, apices with a crown; pappus of 2 subulate scales, apex dilated, 5–6 mm, straight or somewhat curved, smooth. Chromosome number not known.

Distribution and habitat. *Grindelia adenodonta* has been collected from thickets, prairies, and along streams, from 10 to 200 m in Texas (U.S.A.).

Phenology. *Grindelia adenodonta* flowers from June to October.

Etymology. The specific epithet is taken from the Greek “adeno-,” meaning “gland” and “-odonto,” meaning “tooth,” which refers to the marginal teeth of the leaves that end in a group of sessile, glandular trichomes, a characteristic also seen elsewhere for other species in the genus.

Common name. Lone-star gumweed (<<http://plants.usda.gov/>>).

Discussion. Among the annual species, *Grindelia adenodonta* is characterized by its small radiate heads with subulate phyllaries in subequal series. Similar to *G. microcephala* and *G. pusilla*, with similar radiate heads not exceeding 1.5 cm and phyllaries, this taxon is also from Texas. *Grindelia adenodonta* is recognized by its rugose or striate achenes, the inner flattened, with two subulate scales to 6 mm, in contrast to the smoother, globose or obconic achenes topped by two or three setiform awns seen in *G. microcephala* and *G. pusilla*. In *G. microcephala* f. *angustior*, the achenes resemble those of *G. adenodonta*.

Additional specimens examined. U.S.A. **Texas:** Bexar Co., San Antonio, *Mr. & Mrs. J. Clemens 948* (MO); Comanche Spring, New Braunfels, *F. Lindheimer 919* (NY); Denton Co., Post Oak Belt, ca. 8 mi. S of Denton on Hickory Creek, old Alton Rd., *E. Whitehouse 16425* (NY); Jackson Co., along TX 35 just N of Port Comfort, *M. A. Wetter 605* (NY); Nueces Co., Corpus Christi, *A. A. Heller 1820* (PH); Uvalde Co., Sabinal, *E. J. Palmer 10134* (MO); Tarrant Co., Trinity River, *A. Ruth 284* (PH).

2. *Grindelia arizonica* A. Gray, Proc. Amer. Acad. Arts 17: 208. 1882, as “Arizonica.” TYPE: U.S.A. Arizona: mesa of Black River, 550 ft., Sep. 1874, *J. T. Rothrock 796* (holotype, GH [barcode] 00008420!; isotypes, GH [barcode] 00008422!, US [barcode] 00127632 digital image!).

Grindelia setulifera Wooton & Standl., Contr. U.S. Natl. Herb. 16: 179. 1913. TYPE: U.S.A. New Mexico: high summits, Mogollon Mtns., Sep. 1881, *H. H. Rusby 206* (holotype, US 00127658 [barcode] digital image!; isotypes, F [barcode] 0050292F digital image!, MICH [barcode] 1107424 digital image!, MO [barcode] 714107!, NY [barcode] 169626!).

Grindelia arizonica A. Gray var. *dentata* Steyererm., Ann. Missouri Bot. Gard. 21: 508. 1934. TYPE: U.S.A. New Mexico: Grant Co., Bear Mtn., near Silver City, ca. 8000 ft., 19 Sep. 1903, *O. B. Metcalfe 744* (holotype, US [barcode] 00127633 digital image!; isotypes, MO [barcode] 714106!, NY [barcode] 169597!, RM [barcode] 0001115 digital image!).

Grindelia arizonica A. Gray var. *microphylla* Steyererm., Ann. Missouri Bot. Gard. 21: 508. 1934. TYPE: U.S.A. Arizona: Greenlee Co., along San Francisco River, 10 mi. N of Clifton, 7 Sep. 1902, *A. Davidson 736* (holotype, GH [barcode] 00008424!).

Grindelia arizonica A. Gray var. *stenophylla* Steyererm. Ann. Missouri Bot. Gard. 21: 507. 1934. TYPE: U.S.A. Colorado: near Bayfield, 12 Aug. 1904, *E. O. Wooton 2568* (holotype, US [barcode] 00127634 digital image!).

Perennial subshrubs, 0.25–0.7 m, sometimes with conspicuous xylopodium; stem 1, erect, ramified, glabrous. Leaves sessile, coriaceous, oblong-spatulate to elliptic; blade apex acute, mucronate, margin toothed, teeth ending in a sclerotic tip, simple hairs absent or only at the margins, sessile glandular trichomes on both blade surfaces; basal leaves 5.5–6 × 1–1.1 cm, blades attenuate into a pseudopetiole; cauline leaves 1.5–4.5 × 0.6–1 cm. Heads radiate, pedunculate, ca. 1.5 cm diam.; involucre campanulate, resinous, 8–10 × 8–18 mm; phyllaries in 4 to 6 unequal series, graduated, shortly acuminate, broadly elliptic to narrowly oblong, erect, 4–9 mm, subcoriaceous, with sessile glandular trichomes in pits; acumen flat, 2–3 mm, with sessile glandular trichomes. Ray florets 15 to 20; tube glabrous, ligule elliptic, 7–8 mm, apex entire or lobed. Disk florets with corolla 5–6 mm, with a gradually ampliate throat. Achenes yellowish or dull brownish, elliptic, 4-angled, 3–3.5 mm, striate, with a crown at the apex; pappus of 2 to 4 bristles, 3–5 mm, straight to somewhat curved, barbellate. Chromosome number: $n = 6$ (Pinkava & Keil, 1977: 681; Dunford, 1986: 302).

Iconography. Steyermark (1934: 505, fig. 20); Strother and Wetter (2006: 436).

Distribution and habitat. *Grindelia arizonica* has been found on rocky hillsides, tablelands, canyons, along streams, and prairies with pines and oaks, from 1600 to 2500 m, in Arizona, Colorado, and New Mexico (U.S.A.), and Chihuahua and Durango (Mexico).

Phenology. *Grindelia arizonica* flowers from July to August.

Etymology. The specific epithet refers to the state of Arizona in the United States, where the type specimen was collected.

Common name. Arizona gumweed (<<http://plants.usda.gov/>>).

Discussion. *Grindelia arizonica* is characterized by its radiate heads ca. 1.5 cm diameter, with erect phyllaries, and flat acumen, in unequal series. The glands of the leaves are sessile but are not located in pits.

Gray established the name *Grindelia arizonica*, with no description in 1882, for the specimen collected and described by J. T. Rothrock (1878:

141), who applied the name *G. microcephala*. Three varieties of *G. arizonica* established by Steyermark in 1934 (varieties *dentata*, *microphylla*, and *stenophylla*) have no taxonomic standing since the size and the margin of leaves—characters that distinguished the varieties for Steyermark—are variable within the species. Nesom (1990) included a fourth variety by Steyermark, *G. arizonica* var. *stenophylla*, as a synonym of *G. decumbens*, but this species has reflexed phyllaries and the glands of the leaves are in pits.

Additional specimens examined. MEXICO. **Chihuahua:** 29 km W of Colonia Alvaro, *J. L. Neff* 8-19-91-3 (GH). **Durango:** dry fields S of town, *C. F. Baker*, *F. S. Earle* & *S. M. Tracy* 538 (GH). U.S.A. **Arizona:** Coconino Co., 1/2 mi. N of mile marker 318 on state hwy. 209, *D. Walter* & *V. Walter* 10549 (MO); Gila Co., mesa near Barnhart Creek, *R. E. Collom* 463 (MO); Sierra Ancha, *G. J. Harrison* & *T. H. Kearney* 8334 (US). **Colorado:** Archuleta Co., along US 84, *M. A. Wetter* 1033 (NY); Pagosa Springs, *C. F. Baker* 682 (GH); La Plata Co., 5.9 mi. E of La Plata–Montezuma Co. line, *M. A. Wetter* 774 (NY); Montezuma Co., Mesa Verde Natl. Park, roadside, *J. A. Moore* & *J. A. Steyermark* 3773 (MO); 2.35 mi. near Dolores, *M. A. Wetter* 969 (NY). **New Mexico:** Río Arriba Co., Carson Natl. Forest, *M. A. Wetter* 700 (NY); Sandoval Co., 10.6 mi. S of Sandoval–Río Arriba Co. line, *M. A. Wetter* 955 (NY).

3. *Grindelia camporum* Greene, Man. Bot. San Francisco, 171. 1894. TYPE: U.S.A. California: Antioch, 5 Sep. 1881, *E. L. Greene* s.n. (lectotype, designated by Lane [1992: 216], MO-130218!).

Grindelia robusta Nutt. var. *rigida* A. Gray, Bot. California [W. H. Brewer] 1: 304. 1876. TYPE: U.S.A. California: Monte Diablo, 1860–1862, *W. H. Brewer* 850 (lectotype, designated by Lane [1992: 216], GH [barcode] 00037709!).

Grindelia procera Greene, Man. Bot. San Francisco, 172. 1894. TYPE: U.S.A. California: San Joaquín Co., Banta, 9 Sep. 1892, *F. T. Bioletti* s.n. (lectotype, designated by Lane [1992: 216], UC [barcode] 32097 digital image!).

Grindelia bracteosa J. T. Howell, Madroño 2: 22. 1931, syn. nov. *Grindelia rubricaulis* DC. var. *bracteosa* (J. T. Howell) Steyermark, Ann. Missouri Bot. Gard. 21: 227. 1934. *Grindelia robusta* Nutt. var. *bracteosa* (J. T. Howell) D. D. Keck, Aliso 4: 102. 1958. *Grindelia camporum* Greene var. *bracteosa* (J. T. Howell) M. A. Lane, Novon 2: 216. 1992. TYPE: U.S.A. California: Orange Co., in hard clay soil, hills on N side of Santa Ana Canyon, 600 ft., 16 July 1927, *J. T. Howell* 2786 (holotype, CAS [barcode] 00123700 digital image!; isotypes, CAS [barcode] 00123701 digital image!, RSA [barcode] 0001217 digital image!).

Grindelia camporum Greene var. *abbreviata* Steyermark, Ann. Missouri Bot. Gard. 21: 228. 1934. TYPE: U.S.A. California: Los Angeles Co., Lancaster, 23 Sep. 1927, *R. Hoffmann* s.n. (holotype, SBBG [barcode] 000062 digital image!).

Grindelia camporum Greene var. *australis* Steyermark, Ann. Missouri Bot. Gard. 21: 228. 1934. TYPE: U.S.A. California: Los Angeles Co., 3 mi. E of Elizabeth Lake, 4 Sep. 1928, *P. A. Munz* & *I. M. Johnston* 11157 (holotype, RSA [barcode] 0001218 digital image!; isotype, MO-714105!).

Grindelia camporum Greene var. *parviflora* Steyermark, Ann. Missouri Bot. Gard. 21: 534. 1934. TYPE: U.S.A. California: Contra Costa Co., Liberty School on Marsh Creek Rd., 28 Sep. 1930, *J. T. Howell* 5496 (holotype, CAS [barcode] 00123704 digital image!; isotypes, GH [barcode] 00037686!, MO-1015935!).

Grindelia rubricaulis DC. var. *elata* Steyermark, Ann. Missouri Bot. Gard. 21: 227. 1934, syn. nov. TYPE: U.S.A. California: Ventura Co., 7 mi. SW of Simi, 29 May 1931, *J. Jowell* 6574 (holotype, CAS [barcode] 00123670 digital image!).

Perennial subshrubs to 1.5 m; stems 1 or several, erect, ramified, with sessile glandular trichomes. Leaves sessile, coriaceous, ovate to oblong, clasping; blade apex acute or obtuse, margin entire or toothed, teeth ending in a sclerotic tip, simple hairs absent or only at the margins, sessile glandular trichomes in pits on both blade surfaces; basal leaves 7–9 × 2–3 cm; cauline leaves progressively smaller. Heads radiate, pedunculate, 2–3 cm diam.; involucre hemispheric, resinous, 10–15 × 15–25 mm; phyllaries in 4 to 6 unequal series, graduated, acuminate; the outer and middle bracts narrowly ovate, spreading to reflexed, 4–6 mm, glabrous; acumen terete or subterete, curved, 2–3 mm, with sessile glandular trichomes in pits; the upper bracts narrowly elliptic, erect, shortly acuminate, 10 mm. Ray florets 15 to 40; tube glabrous, ligule elliptic to ovate, 8–15 mm, apex entire or toothed. Disk florets with corolla 6–7 mm, with a gradually ampliate throat. Achenes yellowish or dull brownish yellow, 2- or 3-angled, broadly elliptic, 3–5 mm, smooth, obliquely truncate or with a crown at the apex; pappus of 2 or 3 subulate scales, 3–7 mm, straight, smooth. Chromosome numbers: $n = 6$ (Dunford, 1986: 299, sub *Grindelia procera*; Lane & Li, 1993: 541); $2n = 12$ (Raven et al., 1960: 126; Semple et al., 1992: 53; Lane & Li, 1993: 541); $2n = 24$ (McLaughlin, 1986: 1748).

Iconography. Jepson (1925: 1021, fig. 924); Steyermark (1934: 540, fig. 29).

Distribution and habitat. *Grindelia camporum* has been collected from alluvial clay, sandy, or rocky soils, prairies, hillsides, roadsides, and disturbed sites, from 150 to 1400 m, in California (U.S.A.).

Phenology. *Grindelia camporum* flowers from March to October.

Etymology. The specific epithet is taken from the Greek “camphora-” or “camphor,” which refers to the aromatic resin of the leaves.

Common name. Great Valley gumweed (<<http://plants.usda.gov/>>).

Discussion. Among the species from California, *Grindelia camporum* is quite distinctive by its coriaceous leaves with sessile glandular trichomes in pits on both blade surfaces, and by its heads with acuminate phyllaries, with terete or subterete and curved acumen, arranged in unequal series.

Three varieties, *Grindelia camporum* var. *abbreviata*, *G. camporum* var. *australis*, and *G. camporum* var. *parviflora*, were established by Steyermark (1934) and are here considered synonyms of *G. camporum*, since the size of leaves and heads and the number of ray florets—characters utilized by Steyermark for their differentiation—are variable within the species. Two other varieties of *G. camporum* described by Steyermark (1934), variety *davyi* (Jeps.) Steyerm. and variety *interioris* (Jeps.) Steyerm., are here referred to the synonymy of *G. humilis* Hook. & Arn. var. *humilis*, a species in which the phyllaries are subequal with the acumen triangular, flat or subterete, and as long as the base.

Strother and Wetter (2006) included *Grindelia camporum* in the synonymy of *G. hirsutula*. We do not agree with their taxonomic opinion because *G. hirsutula* has hirsute to lanuginous stems rather than the glandular trichomes seen in *G. camporum*. Further distinctions in *G. hirsutula* are the herbaceous or subcoriaceous leaves with simple hairs (vs. coriaceous with glandular trichomes), the sessile glandular trichomes that are not in pits (as in *G. camporum*), and the phyllaries that are subulate (vs. acuminate).

Another variety described by Steyermark (1934) under a different species, *Grindelia rubricaulis* var. *elata*, corresponds well to *G. camporum* with its resinous-punctate leaves and its acuminate phyllaries.

Grindelia bracteosa is newly referred to *G. camporum* herein, based on its leaves and involucre. In the type that has mature achenes, most of the ligulate flowers have fallen off, so its heads were described as having “all disk-flowers or rarely 1 or few minute ray-flowers.” This is in agreement with Lane (1993), who referred to the name as the variety *G. camporum* var. *bracteosa*. She further noted that her variety was possibly derived from the hybrid *G. camporum* × *G. hirsutula* and *G. squarrosa* var. *serrulata* (Rydb.) Steyerm. (a name referred to *G. squarrosa* f. *squarrosa* in this paper).

Additional specimens examined. U.S.A. **California:** Alameda Co., Sunol, *D. Demaree* 10522a (MO); Mocho Creek, Livermore, *J. T. Howell* 10827 (MO); along roadside, 1 mi. S of Mission San José, *E. A. Purer* 5462 (MO); Colusa Co., Maxwell–Colusa Rd. just E of Two Mile Rd., ca. 2 mi.

E of Maxwell, *V. Oswald* 4410 (MO); Contra Costa Co., W of Tracy, *J. A. Moore* & *J. A. Steyermark* 3683 (MO); Glenn Co., ditch betw. Norman & Willows on U.S. Hwy. 99, *A. A. Heller* 15483 (MO); Sacramento Natl. Wildlife Refuge S of Willows, *V. Oswald* 4408 (MO); Kern Co. betw. U.S. Hwy. 5 & canal on E side of hwy. just S of intersection of 1 & 5 ca. state hwy. 46, *M. A. Lane* 3097 (MO); Los Angeles Co., El Segundo, *D. Demaree* 10248 (MO); hills Los Angeles, July 1889, *H. E. Hasse* s.n. (MO-795951); ca. 0.25 mi. E of Green Valley Rd. on Elizabeth Lake Rd. (to Leona Valley & Palmdale), *M. A. Lane* 3093 (MO); San Gabriel, *F. W. Peirson* 8190 (MO); along roadside, *E. A. Purer* 4994 (MO); Marin Co., San Anselmo, *J. T. Howell* 11462 (MO); Ignacio, *J. T. Howell* 11721 (MO); Mariposa Co., Mariposa, *J. T. Howell* 8133 (MO); Merced Co., Merced, *J. T. Howell* 5329 (MO); Monterey Co., Cypress Point, *L. S. Rose* 33348A (MO); Orange Co., Newport Beach, coast hwy., *C. B. Wolf* 8101 (MO); San Diego Co., Oceanside, *S. B. Parish* 4452 (MO); mi. N of Chula Vista, *E. A. Purer* 5045 (MO); along hwy., Silver Strand Beach State Park, *E. A. Purer* 5902 (MO); San Francisco Co., S San Francisco, *D. Demaree* 10469 (MO); San Joaquin Co., 1 mi. W of San Joaquin River bridge near Lathrop, *J. T. Howell* 5550 (MO); 9.5 mi. from Tracy on Tesla Rd., *J. T. Howell* 10842 (MO); Corral Hollow Creek, 8 mi. from Tracy on Tesla Rd., *J. T. Howell* 10849 (MO); Stockton, *E. E. Stanford* 719 (MO); near Lathrop, *W. N. Suksdorf* 8 (MO); San Luis Obispo Co., along CA State hwy. 58 to Santa Margarita, *M. A. Lane* 3098 (PH); Santa Barbara Co., Summerland, *P. A. Munz* 12916 (MO); Santa Clara Co., Alviso, *C. F. Baker* 1701 (MO); Solano Co., Pleasant Valley, W of Vacaville, *A. A. Heller* 16312 (MO); Montezuma Hills, *J. T. Howell* 11648 (MO); Collinsville, *J. T. Howell* 11692 (MO); Sonoma Co., 6 mi. from Sonoma, s. coll. (MO); Stanislaus Co., 1.5 mi. of Modesto, *J. T. Howell* 4550 (MO); Ventura Co., coastal flat at Little Sycamore Creek, Malibu Hwy. to Oxnard, *J. T. Howell* 6566 (MO).

4. *Grindelia confusa* Steyerm., Publ. Field Mus. Nat. Hist., Bot. Ser. 17(5): 442. 1938. TYPE: Mexico. Chihuahua: swale, Namiquipa plains, 17 Aug. 1936, *D. H. LeSueur* 1016 (holotype, F [barcode] 0050294F digital image!; isotypes, MO-1265304!, PH [barcode] 00047853!, TEX [barcode] 00373588!). Figure 3.

Annual subshrubs, ca. 0.15 m; stems 1 to 8, erect, slender, ramified, with simple hairs and stipitate glandular trichomes. Leaves herbaceous, sessile, linear to narrowly ovate, pinnatisect; blade apex acute, margin toothed, the teeth ending in a sclerotic tip, with simple hairs and stipitate glandular trichomes on both blade surfaces; basal leaves 1.5–3.3 × 0.2–0.5 cm; cauline leaves progressively smaller. Heads radiate, pedunculate, 2.5–3 cm diam.; involucre hemispheric-campanulate, scarcely resinous, 7–8 × 13–15 mm; phyllaries in 4 or 5 unequal series, graduated, long acuminate, subcoriaceous, linear-elliptic, spreading to reflexed, 2–5 mm; acumen terete, 1–2.5 mm. Ray florets 25 to 31; tube glabrous, ligule elliptic, 8–12 mm, apex entire. Disk florets with corolla 4–5 mm, with a gradually ampliate throat. Achenes dull brownish yellow,

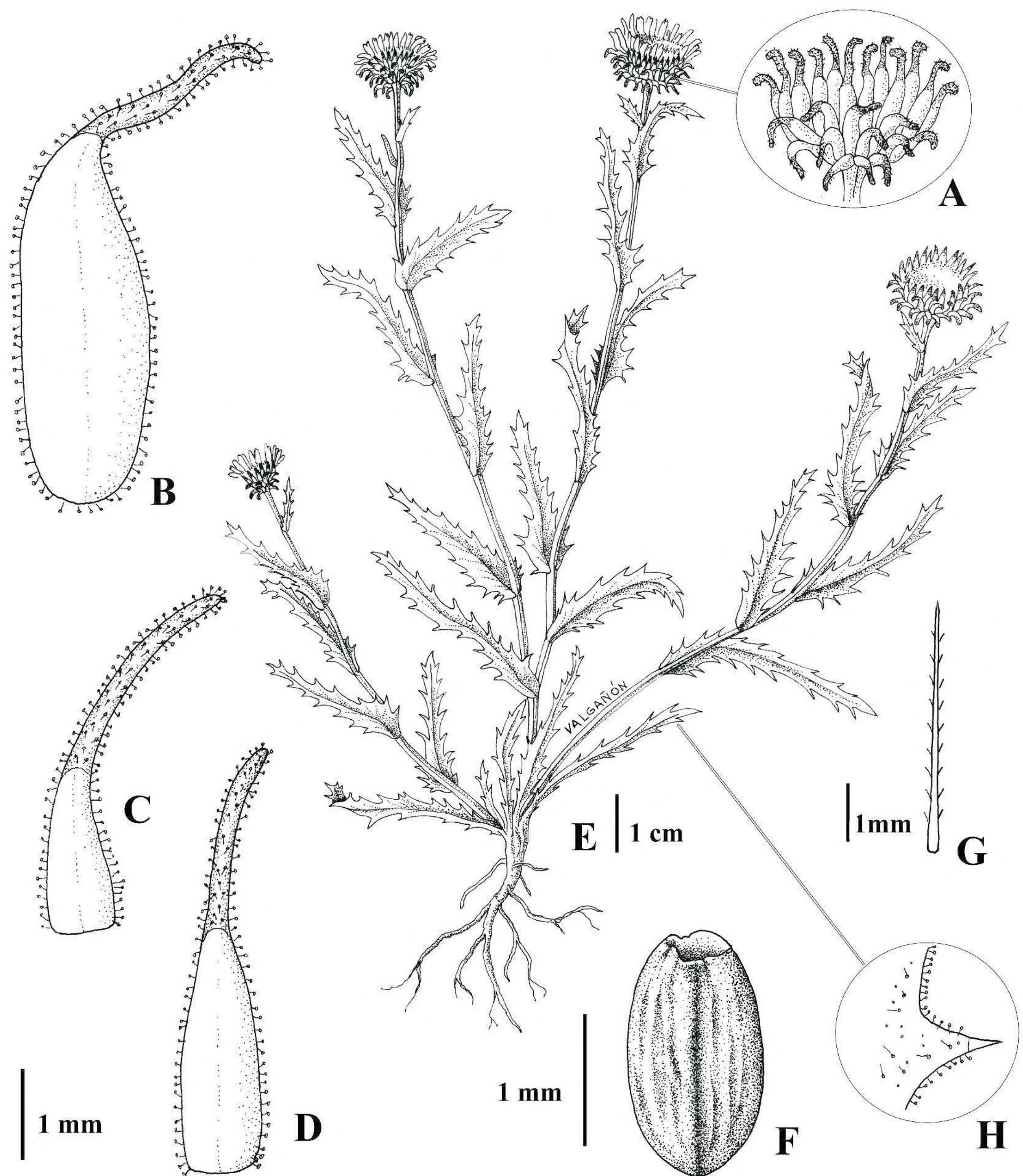


Figure 3. *Grindelia confusa* Steyermark. —A. Involucre, with phyllaries in four or five series. B–D. Representative phyllaries. —B. Inner series. —C. Outer series. —D. Middle series. —E. Fertile habit. —F. Achene, showing the longitudinal furrows. —G. Pappus, showing one of two barbellate bristles. —H. Leaf tooth, ending in a sclerotic tip, with simple hairs and stipitate glandular trichomes seen on both blade surfaces. Drawn from *M. A. Lane 2276 with R. Sanders (TEX)*.

subquadrate to quadrate, 2–2.5 mm, smooth to deeply transverse or longitudinally furrowed, apex truncate; pappus of 2 bristles, straight, 3–4 mm, barbellulate. Chromosome number: $n = 6$ (Lane & Li, 1993: 541).

Distribution and habitat. *Grindelia confusa* has been collected from sandy and saline soils and humid

grasslands, from 1800 to 2150 m, in Chihuahua, Durango, and Tamaulipas (Mexico).

Phenology. *Grindelia confusa* flowers from July to August.

Etymology. The specific epithet is taken from the Latin “confusum,” meaning “uncertain.” Steyermark

(1938) found this species different from the species monographed in 1934 and indicated his initial confusion.

Discussion. *Grindelia confusa* is an annual species that differs from the other Mexican species of *Grindelia* by its simple hairs and stipitate glandular trichomes, its herbaceous, pinnatisect leaves, and its phyllaries with a long and terete acumen, arranged in (four or five) unequal series.

Additional specimens examined. MEXICO. **Chihuahua:** Mpio. Valentín Gómez Farías, *T. Lebgue & E. Estrada 3316* (TEX). **Durango:** in slightly saline meadows, 19 mi. NE of Durango, rte. 31, *D. S. Correll & I. M. Johnston 20165* (TEX); 12.3 mi. W of town plaza of Guadalupe Victoria, on hwy. 40 & just W of Hernández, *M. A. Lane 2273 with R. Sanders* (TEX); 23.2 mi. W of Guadalupe Victoria (town plaza) & 11.3 rd. mi. W of San Francisco, I. Madero on hwy. 40, *M. A. Lane 2276 with R. Sanders* (TEX). **Tamaulipas:** Matamoros, 16 July 1980, *E. Guevara s.n.* (XAL).

5. *Grindelia decumbens* Greene, *Pittonia* 3: 102. 1896. TYPE: U.S.A. Colorado: Cimarron, 30 Aug. 1896, *E. L. Greene s.n.* (holotype, NDG-53581 digital image!; isotype, NDG-53582 digital image!).

Perennial subshrubs, 0.15–0.5 m, with conspicuous xylopodium; stems 3 to 8, prostrate with tips rising upward, ramified, glabrous. Leaves herbaceous, sessile, entire or pinnatisect, narrowly oblong to spatulate; blade apex acute, margin entire or toothed, teeth ending in a sclerotic tip, simple hairs absent, sessile glandular trichomes in pits on both blade surfaces; basal leaves 2–8 × 0.6–1.5 cm; cauline leaves clasping, progressively smaller. Heads radiate, pedunculate, 1.5–2 cm diam.; involucre hemispheric-campanulate, moderately resinous, 8–11 × 6–15 mm; phyllaries in 5 or 6 unequal series, graduated, acuminate, linear-elliptic to narrowly oblong, reflexed, 3–7 mm, glabrous; acumen triangular, subterete, erect, 1–1.5 mm, with sessile glandular trichomes in pits. Ray florets 12 to 24; tube glabrous, ligule narrowly elliptic, 7–12 mm, apex entire or toothed. Disk florets with corolla 5–6 mm, with a gradually ampliate throat. Achenes yellowish or dull brownish, elliptic, 3- or 4-angled, 3–3.5 mm, somewhat striate, apex truncate or knobby; pappus of 2 to 5 setiform awns, 3–5 mm, curved, barbellate to barbellulate. Chromosome number: $2n = 12$ (Whitaker & Steyermark, 1935: 71).

Iconography. Steyermark (1934: 540, fig. 18).

Distribution and habitat. *Grindelia decumbens* has been found on plains, slopes, and stream banks, from 200 to 3000 m, in Colorado and northern New Mexico (U.S.A.).

Phenology. *Grindelia decumbens* flowers from July to August.

Etymology. The specific epithet is taken from the Latin adjective “decumbens” or “prostrate,” which refers to the habit of the species.

Common name. Reclined gumweed (<<http://plants.usda.gov/>>).

Discussion. *Grindelia decumbens* is characterized by its prostrate stem bases, leaves with sessile glandular trichomes in pits on both blade surfaces, and the hemispheric-campanulate involucre with reflexed, acuminate phyllaries.

Additional specimens examined. U.S.A. **Colorado:** T. 34 N, R. 3 W, *M. Ownbey 1403* (GH); Conejos Co., dry pasture land near Río Grande, turnoff to Los Pinos & Apache Canyon on State Hwy. 17, *R. G. Walter 4644* (MO); Ouray Co., 13 mi. N of Ouray, *J. A. Moore & J. A. Steyermark 3778* (MO); La Plata Co., Durango, *C. F. Baker, F. S. Earle & S. M. Tracy 497* (GH); Mineral Co., Santa María Reservoir, NW of Creede, *D. Walter & V. Walter 10742* (MO); Montrose Co., *J. A. Moore & J. A. Steyermark 3780* (MO). **New Mexico:** Río Arriba Co., Chama, *M. Hebard 2156A* (GH).

6. *Grindelia fastigiata* Greene, *Pittonia* 3: 102. 1896. TYPE: U.S.A. Colorado: Grand Jct., 27 Aug. 1896, *E. L. Greene s.n.* (holotype, NDG-53589 digital image!; isotype, NDG-53586-88 three digital images!).

Perennial subshrubs, 0.3–1.5 m; stems 2 to 4, erect, ramified, glabrous. Leaves sessile, subcoriaceous, oblong-spatulate to elliptic; blade apex acute or obtuse, margin entire, denticulate, or serrate, teeth ending in a sclerotic tip, glabrous, sometimes with margins scabrous, sessile glandular trichomes in pits on both blade surfaces; basal leaves 7–10 × 1.5–2 cm, blades attenuate into a pseudopetiole; cauline leaves clasping, 2.5–5 × 0.8–1.5 cm. Heads radiate or discoid, sessile or subsessile; involucre hemispheric-campanulate, resinous, 10–14 × 9–17 mm; phyllaries in 5 or 6 unequal series, graduated, acuminate, linear-elliptic to elliptic, reflexed, 3–9 mm, glabrous; acumen narrowly ovate, terete or subterete, strongly revolute, 1.5–2 mm, with sessile glandular trichomes. Ray florets present or absent. Disk florets with corolla 5–6 mm, with a gradually ampliate throat. Achenes dark brownish yellow, 2-angled, elliptic, 3.5–5 mm, smooth or striate, apex truncate or somewhat knobby; pappus of 2 or 3 setiform awns, 3–3.5 mm, straight, barbellulate.

Etymology. The specific epithet is taken from the Latin “fastigiatus,” which refers to the branches being clustered, parallel, and erect.

Discussion. *Grindelia fastigiata* is characterized by its phyllaries arranged in (five or six) unequal series, with the acumen terete or subterete and strongly revolute. The taxon is morphologically similar to *G. nana*, with both taxa having leaves with sessile glandular trichomes in pits, with teeth ending in a sclerotic tip, and phyllaries with revolute acumen. *Grindelia fastigiata* differs from *G. nana* by its wider leaves (vs. leaves only to 1 cm wide), bigger heads (vs. only to 10 mm diameter), and 2-angled achenes (vs. 4-angled).

Strother and Wetter (2006) considered *Grindelia fastigiata* a synonym of *G. hirsutula*. Nevertheless, both species are quite different: the phyllaries are subulate in *G. hirsutula* (vs. acuminate in *G. fastigiata*), the achene apex forms a crown (vs. truncate in *G. fastigiata*), and the pappus is formed by somewhat curved, subulate scales (vs. setiform awns in *G. fastigiata*).

The following couplet distinguishes the two varieties of *Grindelia fastigiata*:

- 1a. Heads discoid 6a. *G. fastigiata* var. *fastigiata*
1b. Heads radiate 6b. *G. fastigiata* var. *revoluta*

6a. *Grindelia fastigiata* var. *fastigiata*.

Grindelia inornata Greene, Pittonia 3: 102. 1896, syn. nov.
TYPE: U.S.A. Colorado: Cañon City, 7 Aug. 1896, *E. L. Greene* s.n. (holotype, NDG-53597 digital image!; isotypes, NDG-53587 digital image!, RM [barcode] 0001118 digital image!).

Grindelia inornata Greene var. *angusta* Steyermark, Ann. Missouri Bot. Gard. 21: 496. 1934, syn. nov. TYPE: U.S.A. Colorado: Colorado Springs, 1903, *H. L. Shantz* 597 (holotype, US [barcode] 00127640 digital image!).

Heads discoid. Chromosome numbers: $n = 6$ (Dunford, 1986: 301, op. cit. sub *Grindelia inornata*); $2n = 12$ (Cronquist, 1994: 256).

Iconography. Cronquist (1994: 257).

Distribution and habitat. *Grindelia fastigiata* var. *fastigiata* has been found on prairies and along streams, ca. 1500 m, in Colorado (U.S.A.).

Phenology. *Grindelia fastigiata* var. *fastigiata* flowers from June to October.

Common name. Pointed gumweed (<<http://plants.usda.gov/>>).

Discussion. Steyermark (1934) differentiated *Grindelia fastigiata* from *G. inornata* by its longer and fastigate branches. Nevertheless, there are intermediate specimens, e.g., *J. A. Moore* & *J. A. Steyermark* 3770 and 3771 (both MO). Moreover, the leaves are widely variable within the species, and for

this reason we also include the narrower-bladed *G. inornata* var. *angusta* within the synonymy of *G. fastigiata* var. *fastigiata*.

Additional specimens examined. U.S.A. **Colorado:** Denver Co., prairie, *I. W. Clokey* 4324 (PH); Cheyenne Canyon, 21 Aug. 1915, *J. A. Drushel* s.n. (MO 782485); clay soil, *A. Eastwood* 63 (MO); Denver, *J. H. Redfield* 2964 (MO); El Paso Co., at W entrance for Manitou Springs, *M. A. Wetter* 836 (NY); Fremont Co., Denver, 5 mi. E of Florence, *I. W. Clokey* 4323 (MO); Cañon City, plants grown from *J. A. Moore* & *J. A. Steyermark* 3183, collected by Steyermark at MO (MO); Mesa Co., 6.4 mi. E of Colorado–Utah state line, *M. A. Wetter* 568 (NY); Otero Co., 31 mi. NE of Las Animas–Otero Co. line, *M. A. Wetter* 822 (NY). **Utah:** Emery Co., 5 mi. E of Woodside, desert near roadside, *J. A. Moore* & *J. A. Steyermark* 3770 (MO); Grand Co., sand along Colorado River near Moab, *J. A. Moore* & *J. A. Steyermark* 3771 (MO); N bank of Colorado River at hwy. 180 bridge, Moab, *M. P. Dunford* 1173 (NY); ca. 1 mi. N of Professor Creek, Richardson Amphitheater, vic. Fisher Towers, along rd. to Fisher Valley, *S. L. Welsh* 12631 (NY); Fisher Towers, *B. Franklin* 4350 (NY).

6b. *Grindelia fastigiata* var. *revoluta* (Steyermark.)

Adr. Bartoli & Tortosa, comb. et stat. nov.
Basionym: *Grindelia revoluta* Steyermark, Ann. Missouri Bot. Gard. 21(3): 496–497, fig. 15. 1931. TYPE: U.S.A. Colorado: El Paso Co., along roadside, 14 mi. S from Colorado Springs, 1830 m, 30 Aug. 1931, *J. A. Moore* & *J. A. Steyermark* 3784 (holotype, MO-1027335!).

Heads radiate, 2–3.5 cm diam. Ray florets 21 to 37; tube glabrous, ligule narrowly elliptic, 4–11 mm, apex entire or 2-toothed. Chromosome number: $n = 6$ (Dunford, 1986: 297, sub *Grindelia revoluta*).

Iconography. Steyermark (1934: 496, fig. 15).

Distribution and habitat. *Grindelia fastigiata* var. *revoluta* has been found on disturbed sites, roadsides, and sandy prairies, from 900 to 2300 m, in Colorado (U.S.A.).

Phenology. *Grindelia fastigiata* var. *revoluta* flowers from May to August.

Etymology. The name of *Grindelia fastigiata* var. *revoluta* is taken from the Latin “revolutus,” meaning “rolled back,” which refers to the phyllaries that roll from the apex toward the outside of the hemispheric-campanulate heads.

Discussion. We consider *Grindelia revoluta* simply a variety of *G. fastigiata* because the single difference between both species is the presence (or absence) of ray florets. Strother and Wetter (2006) also synonymized *G. revoluta*, but with *G. hirsutula* (see discussion under *G. fastigiata*).

Additional specimens examined. U.S.A. **Colorado:** El Paso Co., sandy prairie, 5 mi. E of Peyton, *J. A. Moore & J. A. Steyermark* 3785 (MO); N of El Paso–Pueblo Co. line, *C. F. Craig & M. A. Wetter* 1774 (NY); Palmer Lake, Rte. 85, *F. W. Pennell & R. L. Schaeffer Jr.* 24683 (PH); at W entrance, archway for Manitou Springs, *M. A. Wetter* 925 (NY); Mesa Co., plateau Creek Canyon, 1/2 mi. from I-70 at mouth of small side canyon on S side of creek, *D. Walter & V. Walter* 11546 (MO); Pueblo Co., rest area betw. Pueblo & Colorado City, *M. A. Wetter* 729 (NY); near St. Charles River, S side, *M. A. Wetter* 920 (NY).

7. *Grindelia fraxinipratensis* Reveal & Beatley, Bull. Torrey Bot. Club 98: 334. 1971 [1972], as “fraxino-pratensis.” [The hyphen use is a correctable orthographic error, fide Art. 60.9.]. TYPE: U.S.A. Nevada: Nye Co., 21 Aug. 1968, *J. L. Reveal* 1887 with *N. H. Holmgren* (holotype, US [barcode] 00008205!; isotypes, ARIZ-186626 digital image!, ASU [barcode] 0017179 digital image!, CAS [barcode] 00123705 digital image!, DS-644237 digital image!, G [barcode] 00223903 digital image!, LL [barcode] 00373589 digital image!, MICH [barcode] 1107421 digital image!, NY [barcode] 169602!, P [barcode] 00744054 digital image!, PH [barcode] 00047855 digital image!, RSA [barcode] 0001221 digital image!, SD [barcode] 00000096 digital image!, UC [barcode] 1395189 digital image!, WTU-286407 digital image!). Figure 4.

Perennial subshrubs, 0.5–1.2 m; stems 1 to 5, erect, slender, ramified, glabrous. Leaves subcoriaceous, sessile, narrowly elliptic; blade apex acute, margin entire or toothed, teeth ending in a sclerotic tip, simple hairs absent, sometimes margin scabrous, sessile glandular trichomes in pits on both blade surfaces; basal leaves 5–10 × 0.7–1.5 cm, blades attenuate into a pseudopetiole; blade apex acute or obtuse; cauline leaves clasping, 1.5–7 × 0.3–1.2 cm, apex acute. Heads radiate, pedunculate, 0.8–1.4 cm diam.; involucre obconic, resinous, 7–9 × 5–10 mm; phyllaries in 4 to 7 unequal series, graduated, acuminate, linear-elliptic to ovate, erect to spreading, 2–8 mm, glabrous; acumen triangular, erect, flat, 0.5–2 mm, with sessile glandular trichomes in pits. Ray florets 5 to 13; tube glabrous, ligule elliptic, 3–7 mm, apex entire or toothed. Disk florets with corolla 4–5.5 mm, with a gradually ampliate throat. Achenes yellowish, dull brownish, or dark brownish yellow, 4-angled, elliptic, 2.5–4 mm, striate, apex truncate to knobby; pappus of 2 bristles, 3–4 mm, smooth. Chromosome number: $2n = 24$ (Lane, 1993: 272).

Distribution and habitat. *Grindelia fraxinipratensis* grows on prairies and edges of forests, from 600 to 800 m, in California and Nevada (U.S.A.).

Phenology. *Grindelia fraxinipratensis* flowers from June to October.

Etymology. The specific epithet is taken from the Latin “fraxinipratensis,” meaning “growing in the fields of ash trees.”

Common name. Ash meadows gumplant (<<http://plants.usda.gov/>>).

Discussion. *Grindelia fraxinipratensis* is quite distinct from other North American species of *Grindelia* by its small radiate heads remarkable for their obconic involucre. Heads in other *Grindelia* are more often hemispheric to urceolate or campanulate in their overall appearance.

Additional specimens examined. U.S.A. **California:** Inyo Co., Amargosa, 20 Oct. 1968, *J. Beatley* s.n. (MO-2425710); Ash Meadows, *J. L. Reveal* 1536 (MO); alkaline flat, W Ash Meadows Rd., NW of Ash Meadows Lodge, *J. L. Reveal* 2107 (GH, MO); open meadows & woodland border, 8 Oct. 1970, *J. Beatley* s.n. (GH).

8. *Grindelia grandiflora* Hook., Bot. Mag. 78(ser. 3, vol. 8): pl. 4628. 1852. *Grindelia squarrosa* (Pursh) Dunal var. *grandiflora* (Hook.) A. Gray, Smithsonian Contr. Knowl. 3: 98. 1852. TYPE: [U.S.A.] Cult. in Hort. Kew from seeds collected in Texas, s.d., *Wright* s.n. (holotype, K-000250073 digital image!).

Grindelia costata A. Gray, Proc. Amer. Acad. Arts 17: 208, 1882. TYPE: Mexico. Coahuila: 23–24 Sep. 1880 [label, Feb–Oct. 1880], *E. Palmer* 472 (holotype, GH [barcode] 00008445!; isotypes, K [barcode] 000221373 digital image!, NY [barcode] 00169631!, US [barcode] 00127636 digital image!).

Annual subshrubs, 0.5–1.5 m; stem 1, erect, ramified, glabrous. Leaves herbaceous, sessile, ovate, 2.5–6 × 0.5–0.15 cm, base cordate, clasping; blade apex acute to acuminate, margin with rounded teeth ending in a group of sessile glandular trichomes, occasionally entire in cauline leaves, simple hairs absent, sessile glandular trichomes on both blade surfaces. Heads radiate, pedunculate, 2.5–3 cm diam.; involucre hemispheric, scarcely resinous, 6–8 × 10–15 mm; phyllaries in 5 or 6 unequal series, graduated, acuminate, 3-nerved, with sessile glandular trichomes; the outer bracts linear-elliptic, 4 mm, erect to spreading, acumen filiform, subterete, erect, 2–3 mm; the middle and upper bracts elliptic, 5–7 mm, erect; acumen terete, erect, 1 mm. Ray florets 17 to 26; tube glabrous, ligule elliptic, 10–12 mm, apex entire or scarcely toothed. Disk florets with corolla 6–7 mm, with an abruptly ampliate throat. Achenes dull brownish or brownish yellow, monomorphic, broadly elliptic, 2- or 3-angled, 3–4 mm, longitudinally

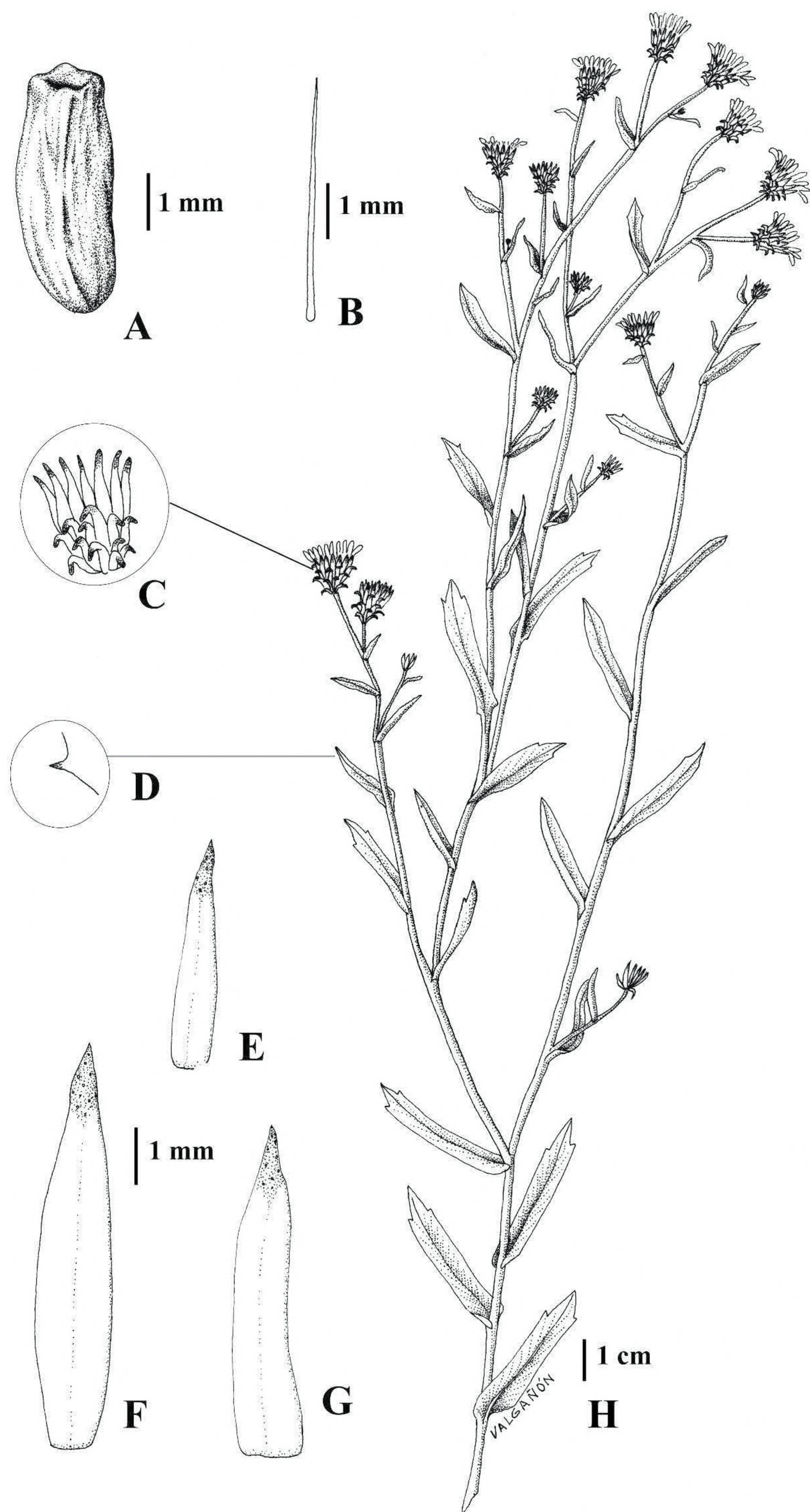


Figure 4. *Grindelia fraxinipratensis* Reveal & Beatley. —A. Achene, 4-angled, striate. —B. Pappus, showing one of two smooth bristles. —C. Involucre, with phyllaries in four to seven series. —D. Leaf tooth, ending in a sclerotic tip. B–D to same 1 mm scale. E–G. Representative phyllaries. —E. Outer series. —F. Inner series. —G. Middle series. —H. Fertile habit. Drawn from *J. L. Reveal 1536* (MO).

striate or furrowed, apex knobby or forming a crown; pappus of 2 bristles, 3–4.5 mm, straight, smooth to barbellulate. Chromosome numbers: $n = 6$ (Pinkava & Keil, 1977: 681; Dunford, 1986: 301); $2n = 12$ (Dunford, 1969: 20; Pinkava & Keil, 1977: 681; Zhao & Turner, 1993: 650).

Iconography. Steyermark (1934: 462, fig. 5).

Distribution and habitat. *Grindelia grandiflora* has been collected from disturbed and sandy soils, in roadsides, open forests, prairies, and streams, from 300 to 1200 m, in Texas (U.S.A) and Coahuila (Mexico).

Phenology. *Grindelia grandiflora* has been collected in flower from the beginning of July to October.

Etymology. The specific epithet refers to the size of the heads, from the Latin “grandiflorus,” meaning “big flowers.”

Common name. Many-ray gumweed (<<http://plants.usda.gov/>>).

Discussion. *Grindelia grandiflora* is characterized by its annual habit and phyllaries with a filiform acumen. Asa Gray considered this species only a variety of *G. squarrosa*. Both species differ in the sessile glandular trichomes (located in pits in the leaves of *G. squarrosa* vs. not in pits in *G. grandiflora*). The acumen of phyllaries ranges from linear to narrowly triangular, terete to subterete in *G. squarrosa* (vs. the noteworthy filiform, subterete acumen in *G. grandiflora*). The pappus consists of curved, setiform awns in *G. squarrosa* (vs. smooth to barbellate bristles in *G. grandiflora*), and the corolla of disk flowers has a gradually ampliate throat in *G. squarrosa* (vs. abruptly ampliate in *G. grandiflora*).

Additional specimens examined. MEXICO. **Coahuila:** Arteaga, Exposición E de la Sierra La Viga, El Zorrillo, J. A. Encina 821 with J. A. Portillo (ASU [barcode] 0018162); Sierra de las Alasanas al noroeste del ejido Mesa de las Tablas, J. A. Encina 826 with S. Cruz J. & E. López (ASU [barcode] 0018163); Muzquiz, roadside swamp, T. Reeves & D. J. Pinkava P13009 (ASU [barcode] 0018164). U.S.A. **Texas:** Crockett Co., N part of Ozona, V. L. Cory 40706 (GH); Edwards Co., Ranch Exp. Station, V. L. Cory 5013 (MO); Fremont, laned county rd., line Sutton Co., 24 air mi. SSE of Sonora, V. L. Cory 52450 (PH); Río Grande Co., Río Grande valley below Doñana, 1879, C. C. Parry et al. s.n. (GH); Sutton Co., SE part of Sonora, V. L. Cory 50544 (US); arroyo in S part of town at end of Poplar St., M. P. Dunford & C. C. Freeman 1157 (MO); E of Sonora, M. A. Wetter 1012 (NY); Tarrant Co., rocky hillsides, A. Ruth 64 (NY); Val Verde Co., along Devils River, 13 Sep. 1900, H. Eggert s.n. (MO-129986).

9. *Grindelia greenmanii* Steyer., Ann. Missouri Bot. Gard. 21: 460. 1934. TYPE: Mexico.

Coahuila: Lerios, mtn. section 15 leagues E of Saltillo, 10,000 ft., 10–13 July 1880, E. Palmer 471 (holotype, GH [barcode] 00008448!; isotypes, K [barcode] 000221374 digital image!, NY [barcode] 00169633 digital image!, PH [barcode] 00047857 digital image!, US [barcode] 00931357 digital image!).

Grindelia vetimontis G. L. Nesom, Phytologia 68: 330. 1990, syn. nov. TYPE: Mexico. Nuevo León: Mpio. Zaragoza, Cerro El Viejo, 15 mi. W Dulces Nombres, 18 Aug. 1948, F. G. Meyer & D. J. Rogers 2988 (holotype, MO-193880!; isotype, F [barcode] 1587883F digital image!).

Rhizomatous perennial subligneous subshrubs, 0.25–0.5 m; stems several, erect, ramified or not, with simple long hairs and generally also with stipitate glandular trichomes. Leaves herbaceous, sessile, oblong-elliptic, 2–11 × 0.5–1.2 cm; blade apex obtuse to acuminate, margin denticulate to finely serrate, teeth ending in a sclerotic tip, simple hairs and stipitate glandular trichomes on both blade surfaces; basal leaves with blades attenuate into a pseudopetiole; cauline leaves clasping, progressively smaller. Heads radiate, sessile, 2–4 cm diam.; involucre hemispheric-campanulate, scarcely resinous, 12–14 × 22–25 mm; phyllaries in 4 or 5 subequal series, acuminate, herbaceous, linear to linear-elliptic, erect to spreading, 8–11 mm, glabrous, margin entire; acumen triangular, flat to subterete, shorter than the base, 3–4 mm, with stipitate glandular trichomes. Ray florets 25 to 30; tube with stipitate glandular trichomes, ligule elliptic, 12–16 mm, apex entire. Disk florets with corolla 5–7 mm, with an abruptly ampliate throat. Achenes brownish, elliptic, 2-angled, flattened, 2.5–3 mm, smooth or slightly rugose, apex truncate; pappus of 2 or 3 bristles, 5–7 mm, smooth. Chromosome number: $n = 6$ (Pinkava & Keil, 1977: 681).

Iconography. Steyermark (1934: 460, fig. 4).

Distribution and habitat. *Grindelia greenmanii* grows in open forests of *Pinus* L. and *Picea* Link., from 2200 to 3650 m, in Coahuila, Nuevo León, and Tamaulipas (Mexico).

Phenology. *Grindelia greenmanii* flowers from June to December.

Etymology. *Grindelia greenmanii* was named in honor of Jesse More Greenman (1867–1951), curator of the Missouri Botanical Garden, who studied tropical flora, particularly from Mexico.

Discussion. *Grindelia greenmanii* is different from other *Grindelia* species with a rhizomatous habit, such as *G. obovatifolia* and *G. robinsonii*, with its larger

heads to 4 cm diameter (vs. no more than 2.5 cm diameter in the other two species), and by its phyllaries in subequal series (vs. unequal, graduated series).

When Nesom described *Grindelia vetimontis* in 1990, he stated that this species was allied to *G. greenmanii*, but differed by its eglandular stems and smaller leaves and heads. Nonetheless, we observed intermediate specimens, collected in Cerro Peña Nevada (*G. L. Nesom 4800*, TEX; *D. E. Breedlove 63552*, TEX), and the species name is synonymized.

Additional specimens examined. MEXICO. **Coahuila:** Sierra Coahuilón, *S. Ginzburg et al. 180* (TEX); Cerro La Viga, *G. B. Hinton 20205* (MEXU); El Paso, *G. B. Hinton et al. 24382* (TEX); Arteaga, Sierra Coahuilón, *G. B. Hinton 20996* (MEXU); Arteaga, Sierra Los Camargos, *G. B. Hinton et al. 18344* (XAL); Los Lirios a El Cercado, 2405 m, *G. B. Hinton et al. 25428* (MEXU, TEX). **Nuevo León:** Mpio. Monterrey, 18 de Marzo, Cerro Potosí, below the summit on cobble roadside, 3429 m, *E. M. Chittenden 104* (TEX); Cerro El Potosí, 2750 m, *F. Garza & E. Estrada 4265* (TEX); Mpio. de Galeana, Las Canoas on Cerro Potosí, *C. H. Mueller 2173* (MO); ca. 37 km ENE of Dr. Arroyo, S-trending trail to summit of Cerro Peña Nevada beginning near rd. jct., *G. L. Nesom 4800* (TEX); 2.7 mi. S of San Francisco Javier on rd. betw. San Rafael Jct. & Galeana, on NE side of Cerro Potosí, *G. L. Nesom & J. Norris 7198* (TEX); El Lorito, *G. B. Hinton et al. 19831* (MEXU), *G. B. Hinton 19865* (MEXU); summit Cerro El Potosí, *G. B. Hinton et al. 25335* (MEXU); 18 Marzo to El Lorito, *G. B. Hinton 25388* (MEXU); Mpio. Zaragoza, Cerro El Viejo, *G. B. Hinton et al. 22434* (MEXU). **Tamaulipas:** along logging rd. E of Miquihuana on ridge SE of Cerro Peña Nevada, *D. E. Breedlove 63552* (TEX).

10. *Grindelia hallii* Steyerl., Ann. Missouri Bot. Gard. 21: 229. 1934, as “Hallii.” *Grindelia hirsutula* Hook. & Arn. var. *hallii* (Steyerl.) M. A. Lane, Novon 2: 216. 1992. TYPE: U.S.A. California: San Diego Co., open ridges about Cuyamaca Lake, 30 June 1903, *L. Abrams 3957* (holotype, NY [barcode] 169603!; isotypes, CAS [barcode] 00123706 digital image!, DS-7262 digital image!, F [barcode] 0050285F digital image!, GH [barcode] 00008425!, MO [barcode] 714101 digital image!, RSA [barcode] 0001223 digital image!).

Perennial subligneous subshrubs, 0.25–0.6 m, with xylopodium; stems several, erect, slender, ramified, glabrous. Leaves subcoriaceous, sessile, narrowly elliptic, apex acute, margin entire or toothed, teeth ending in a sclerotic tip, simple hairs absent, sometimes margin scabrous, sessile glandular trichomes in pits on both blade surfaces; basal leaves narrowly obovate, 7–9 × 0.8–1 cm, blades attenuate into a pseudopetiole; blade apex acute or obtuse; cauline leaves elliptic to narrowly elliptic, 2–3.5 × 0.5–1 cm, clasping, apex acute. Heads radiate,

pedunculate, 1.5–2 cm diam.; involucre hemispheric to hemispheric-campanulate, resinous, 8–15 × 12–15 mm; phyllaries in 5 unequal series, graduated, subulate, with sessile glandular trichomes; the outer bracts linear-elliptic, spreading to reflexed, 2 mm, apex flat, 1 mm; the middle bracts ovate-triangular, spreading, 4–6 mm, apex terete or subterete, 2–2.5 mm; the upper bracts elliptic, erect, 6–8 mm. Ray florets 10 to 20; tube glabrous, ligule elliptic, 8–9 mm, apex entire or toothed. Disk florets with corolla 6–7 mm, with a gradually ampliate throat. Achenes light brown, elliptic, 2- or 3-angled, 4–5 mm, smooth to furrowed, apex with a tooth or obliquely truncate; pappus of 2 bristles, 2.5–4 mm, smooth to barbellulate. Chromosome number: $n = 6$ (Raven et al., 1960: 126; Lane & Li, 1993: 541, sub *G. hirsutula* var. *hallii*).

Iconography. Steyermark (1934: 520, fig. 25).

Distribution and habitat. *Grindelia hallii* has been collected from rocky hillsides, from 1400 to 1700 m, in southern California (U.S.A.).

Phenology. *Grindelia hallii* flowers from July to October.

Etymology. *Grindelia hallii* was named in honor of Harvey Monroe Hall (1874–1932), a pioneer in experimental taxonomy and an authority on the study of Asteraceae in southern California.

Common name. San Diego gumplant (<<http://www.calflora.org>>).

Discussion. With its radiate heads with the involucre composed of subulate phyllaries in a graduated series, *Grindelia hallii* is related to *G. oxylepis*. The two taxa differ by the achenes being elliptic and smooth to furrowed, with the apex toothed or obliquely truncate in *G. hallii*. The achenes are subquadrate and tuberculate, with the apex truncate or forming a crown in *G. oxylepis*.

Grindelia hallii was reduced in rank as a variety of *G. hirsutula* by Lane (1992) and was later synonymized to this species by Strother and Wetter (2006). However, *G. hallii* has smaller heads, to 2 cm in diameter, in contrast to the significantly larger heads of *G. hirsutula* that range from 3.5–4 cm in diameter. *Grindelia hallii* has leaves with sessile glandular trichomes located in pits and simple hairs are absent; in *G. hirsutula*, the sessile glandular trichomes are not in pits and simple hairs are present.

Additional specimens examined. U.S.A. **California:** San Diego Co., Julian, *H. P. Chandler 5460* (NY); Cuyamaca Lake, Cuyamaca, *P. A. Muñiz & E. K. Balls 17997* (NY); along CA State hwy. 79, 2.7 mi. SE of California State hwy. 78 in Julian, *M. A. Lane 3088* (MO); Julian, Oct. 1889, *C. R. Orcutt s.n.* (MO-130078); Larkens, 80 mi. E, southern

part of San Diego Co., *E. Palmer* 128 (MO); Cuyamaca Lake, *F. W. Peirson* 4825 (MO); near Julian, 11 Aug. 1886, *C. R. Orcutt s.n.* (MO-130079); 40 mi. E of San Diego, Corte Madera Ranch, Pine Valley, *H. Van der Werff* 6058 (MO); Pine Valley, ca. 50 mi. E of San Diego on Corte Madera Ranch, *H. van der Werff* 8707 (MO).

11. *Grindelia havardii* Steyerl., Ann. Missouri Bot. Gard. 21: 474. 1934. TYPE: U.S.A. Texas: Culberson Co., Guadalupe Mtns., dry gravelly wash near mouth of McKittrick Canyon, 2000 m, 23 July 1931, *J. A. Moore* 3607 with *J. A. Steyermark* (holotype, MO [barcode] 714098!; isotypes, GH [barcode] 00008425!, MO [barcode] 714097 digital image!, MO [barcode] 714099 digital image!, MO [barcode] 714100 digital image!, NY [barcode] 169604!, P [barcode] 00742797 digital image!, RM [barcode] 0001121 digital image!, TEX [barcode] 147304 digital image!).

Perennial subshrubs, 0.3–1.5 m; stems 1 to several, erect, ramified, glabrous or hispid. Leaves subcoriaceous, sessile; blade apex obtuse or acute, margin crenate or toothed, teeth ending in a group of sessile glandular trichomes, simple hairs and sessile glandular trichomes present on both blade surfaces, and stipitate glandular trichomes only along the middle nerve; basal leaves obovate to oblong, $5.5\text{--}6 \times 1.3\text{--}1.5$ cm, blades attenuate into a pseudopetiole; leaves apex obtuse; cauline leaves ovate, $2.5\text{--}3 \times 1\text{--}1.5$ cm, clasping, auriculate; blade apex acute. Heads radiate, pedunculate, 2.5 cm diam.; involucre hemispheric, resinous, $8\text{--}13 \times 12\text{--}22$ mm; phyllaries in 5 or 6 unequal series, graduated, acuminate, with sessile glandular trichomes; the outer and middle bracts linear-elliptic, 4–10 mm, spreading to reflexed; acumen subterete to terete, 2–3.5 mm; the upper phyllaries narrowly elliptic, erect, shortly acuminate. Ray florets 18 to 25; tube glabrous, ligule narrowly oblong, 9–11 mm, apex entire. Disk florets with corolla 6–7 mm, with a gradually ampliate throat. Achenes light brown, elliptic, 2- or 3-angled, 4–5 mm, smooth to furrowed, apex with a tooth or obliquely truncate; pappus of 2 bristles, 4–7 mm, smooth to barbellulate. Chromosome numbers: $n = 6$ (Dunford, 1986: 297); $2n = 12$ (Powell & Powell, 1978: 161).

Iconography. Steyermark (1934: 476, fig. 11).

Distribution and habitat. *Grindelia havardii* grows on degraded, alluvial soils, and rocky hills, from 1300 to 2000 m, in Texas and New Mexico (U.S.A.), and Coahuila (Mexico).

Phenology. *Grindelia havardii* has been collected in flower from the beginning of June to December.

Etymology. *Grindelia havardii* was named in honor of the American botanist, Valery Havard (1846–1927). She published numerous articles on the flora of the states of Montana, the Dakotas, Texas, and Colorado.

Common name. Havard's gumweed (<<http://www.nature.british-towns.net/>>).

Discussion. *Grindelia havardii* is characterized by its large radiate heads with the acuminate phyllaries arranged in unequal series, with flat acumen, and leaves with teeth ending in sessile glandular trichomes.

M. A. Wetter annotated in type sheets (GH and MO) the transfer of *Grindelia lanceolata* var. *havardii* (Steyerl.) Wetter, but *G. lanceolata* differs from *G. havardii* in their smaller heads with phyllaries arranged in subequal series, linear, terete acumen, and leaves with teeth ending in a curved spinule.

Additional specimens examined. MEXICO. **Coahuila:** roadside ca. 3 mi. SE of Ocampo, *I. M. Johnston* 8881 (GH). U.S.A. **New Mexico:** Chaves Co., 35 mi. W of Roswell, *F. S. Earle & E. S. Earle* 509 (MO). **Texas:** Culberson Co., Pratt Ranch, *B. E. McKechnie* 283 (MO); Jeff Davis Co., Davis Mtns., dry rocky hillside above Little Ajuga Canyon, *J. A. Moore & J. A. Steyermark* 3151 (MO).

12. *Grindelia hintoniorum* G. L. Nesom, Phytologia 68: 328. 1990. TYPE: Mexico. Nuevo León: Mpio. Galeana, E of Pablillo, oak woods, 1940 m, 15 May 1984, *G. B. Hinton et al.* 18666 (holotype, TEX [barcode] 00373591!; isotypes, ASU [barcode] 0017180 digital image!, MEXU-GBH 18666 digital image!, US [barcode] 00406463 digital image!). Figure 5.

Perennial subshrubs, 0.05–0.15 m, with xylopodium; stems several, prostrate with tips rising upward, not ramified, with scattered simple hairs and dense stipitate glandular trichomes. Leaves herbaceous, sessile; blade apex acute or obtuse; margin entire or crenate, teeth ending in a sclerotic tip, blade with simple hairs along the nerves, dense stipitate glandular trichomes on both blade surfaces; basal leaves spatulate-obovate, $5\text{--}7 \times 0.5\text{--}0.6$ cm, attenuate into a pseudopetiole; blade apex acute; cauline leaves oblong-elliptic, $1\text{--}2.2 \times 0.35\text{--}0.4$ cm, clasping, blade apex obtuse. Heads radiate, pedunculate, 1–1.2 cm diam.; involucre hemispheric, resinous, $7\text{--}8 \times 7\text{--}9$ mm; phyllaries in 5 or 6 subequal series, subulate, triangular to narrowly triangular, glabrous, apex flat to subterete, minutely aristate, with stipitate glandular trichomes; the outer bracts spreading to scarcely reflexed, 4–4.5 mm; the middle bracts spreading to erect, 5–6 mm; the upper

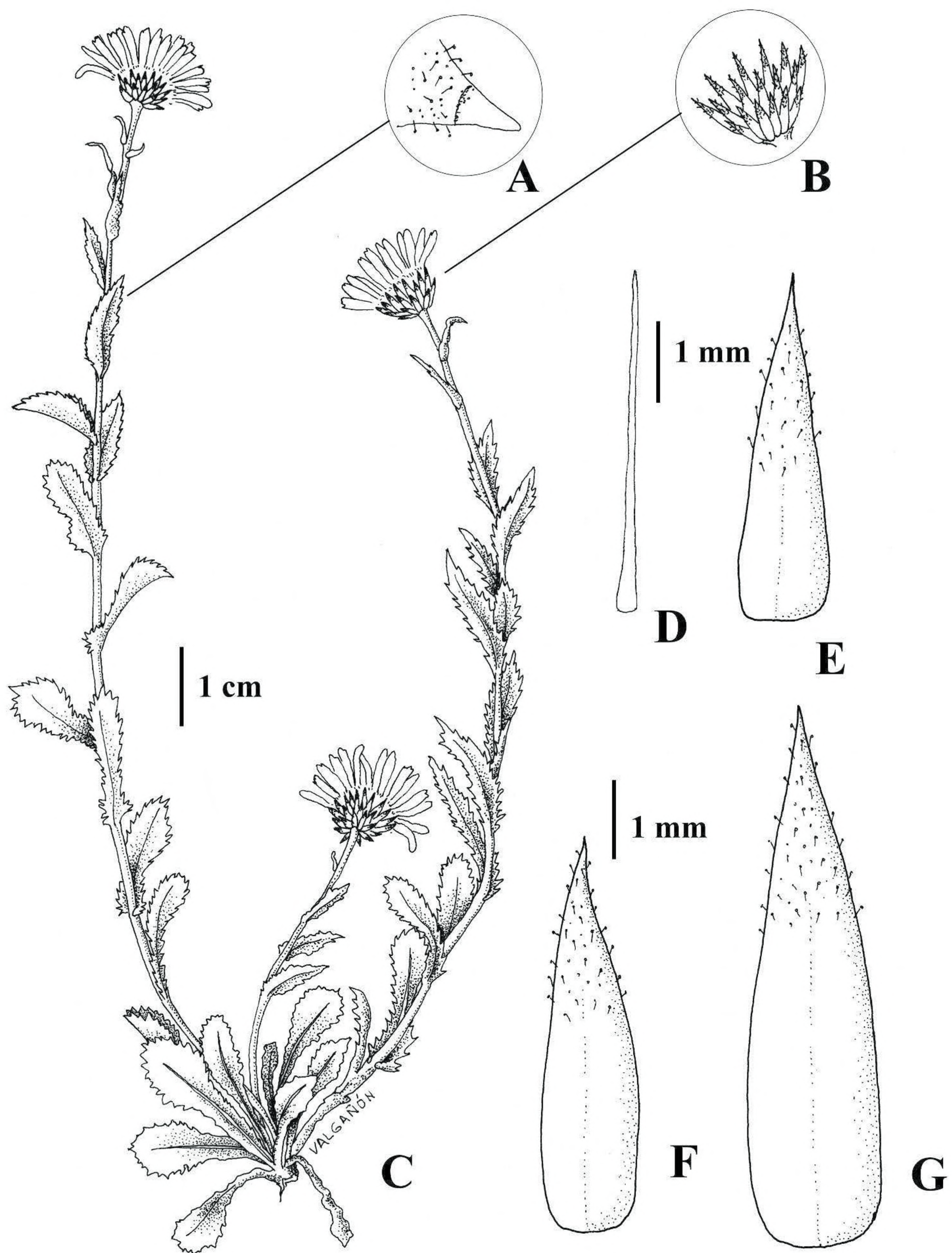


Figure 5. *Grindelia hintoniorum* G. L. Nesom. —A. Leaf tooth, ending in a sclerotic tip, the blade surfaces with dense stipitate glandular trichomes. —B. Part of the involucre; outer phyllary series represented. —C. Fertile habit. —D. Pappus, showing one of two smooth bristles. E–G. Representative phyllaries. —E. Outer series. —F. Middle series. —G. Inner series. D–G to same 1 mm scale. Drawn from *M. Taylor 24* (HB).

phyllaries erect, 7–8 mm. Ray florets 19 to 34; tube glabrous, ligule narrowly elliptic, 9–11 mm, apex entire. Disk florets with corolla 4.5–5 mm, with an abruptly ampliate throat. Achenes not seen; pappus of 2 bristles, smooth. Chromosome number not known.

Distribution and habitat. *Grindelia hintoniorum* has been collected in calcareous soils, in *Quercus* L. forests and cultivated lands, in Nuevo León (Mexico).

Phenology. *Grindelia hintoniorum* flowers from June to September.

Etymology. *Grindelia hintoniorum* was named in honor of George B. Hinton (1882–1943), collector of plants in southwestern Mexico.

Discussion. *Grindelia hintoniorum* is quite a distinctive species, represented by dwarf plants not exceeding 15 cm and with a xylopodium. The stems and leaves are densely covered by stipitate glandular trichomes; the radiate heads are small, with phyllaries arranged in unequal series, and the acumen flat.

Additional specimens examined. MEXICO. **Nuevo León:** Mpio. Galeana, encinal, Pablillo, Sierra Madre Oriental, *F. W. Pennell 17006* (PH); hacienda, Pablillo, *M. Taylor 24* (PH); 9 km S of San Rafael along hwy. 57 toward San Roberto Jct., Broad Valley (Valle de Potosí), *G. L. Nesom, M. Mayfield & G. B. Hinton 7587* (MO).

13. *Grindelia hirsutula* Hook. & Arn., Bot. Beechey Voy. 147. 1833. TYPE: U.S.A. California: [probably from San Francisco Bay to Monterey Bay, cf. A. Gray, Geol. Surv. Calif. Bot. 1: 304. 1876.] s.d., *Botany Beechey's Voyage s.n.* (holotype, E [barcode] 00369114 digital image!; isotypes, K [barcode] 000250075 digital image!, UC [barcode] 292620 digital image!).

Grindelia rubricaulis DC., Prodr. (DC.) 5: 316. 1836. *Grindelia hirsutula* Hook. & Arn. subsp. *rubricaulis* (DC.) D. D. Keck, Aliso 4: 102. 1958. TYPE: U.S.A. California: 1833, *D. Douglas 55* (holotype, G-DC, IDC microfiche!; isotypes, BM [barcode] 001025308 digital image!, GH [barcode] 00037710 digital image!, K [barcode] 000250076 digital image!, UC [barcode] 292723 digital image!).

Grindelia pacifica M. E. Jones, Bull. Torrey Bot. Club 9: 31. 1882, as "Pacifica." TYPE: U.S.A. California: Santa Cruz Co., on hills at Santa Cruz, 1881, *M. E. Jones s.n.* (holotype, RSA [barcode] 0001227 digital image!; isotypes, GH [barcode] 00037707!, NY [barcode] 8411!).

Grindelia patens Greene, Pittonia 2: 290. 1892. *Grindelia robusta* Nutt. var. *patens* (Greene) Jeps., Fl. W. Calif. 554. 1901. *Grindelia hirsutula* Hook. & Arn. f. *patens* (Greene) Steyerl., Ann. Missouri Bot. Gard. 21: 570. 1934. TYPE: U.S.A. California: Berkeley, July 1881, *E. L. Greene s.n.* (holotype, NDG-53625 digital image!; isotype, F [barcode] 0050291F digital image!).

Grindelia hirsutula Hook. & Arn. f. *cacumena* Steyerl., Ann. Missouri Bot. Gard. 21: 572. 1934, syn. nov. TYPE: U.S.A. California: Oakland Hills, 2000 ft., 1866, *H. N. Bolander 389* (holotype, US [barcode] 00008206 digital image!; isotypes, NY [barcode] 00169609!, NY [barcode] 00169610!).

Grindelia hirsutula Hook. & Arn. var. *brevisquama* Steyerl., Ann. Missouri Bot. Gard. 21: 572. 1934. TYPE: U.S.A. California: Sonoma Co., Black Point Rd., 13 July 1930, *J. T. Howell 5338* (holotype, CAS [barcode] 00123707 digital image!; isotype, UC [barcode] 473549 digital image!).

Grindelia hirsutula Hook. & Arn. f. *glabrata* Steyerl., Ann. Missouri Bot. Gard. 21: 573. 1934, syn. nov. [described under *Grindelia hirsutula* var. *brevisquama*]. TYPE: U.S.A. California: Sonoma Co., 8 mi. W of

Petaluma, 8 June 1930, *J. T. Howell 5221* (holotype, MO-1016008!; isotypes, CAS [barcode] 00123708 digital image!, GH [barcode] 00037693!, RSA [barcode] 0001224 digital image!).

Grindelia hirsutula Hook. & Arn. f. *pedunculoides* Steyerl., Ann. Missouri Bot. Gard. 21: 574. 1934, syn. nov. [described under *Grindelia hirsutula* var. *brevisquama*]. TYPE: U.S.A. California: Calistoga, 7 May 1900, *A. Eastwood s.n.* (holotype, UC [barcode] 134569 digital image!; isotype, GH [barcode] 00037694!).

Grindelia hirsutula Hook. & Arn. f. *tomentulosa* Steyerl., Ann. Missouri Bot. Gard. 21: 574. 1934, syn. nov. [described under *Grindelia hirsutula* var. *brevisquama*]. TYPE: U.S.A. California: San Mateo Co., Crystal Springs Lake, 23 June 1913, *W. N. Suksdorf 279* (holotype, MO-850778!).

Grindelia hirsutula Hook. & Arn. var. *calva* Steyerl., Ann. Missouri Bot. Gard. 21: 575. 1934. TYPE: U.S.A. California: San Luis Obispo Co., San Luis Obispo, spring 1905, *J. E. Roadhouse 65* (holotype, UC [barcode] 75916 digital image!).

Grindelia hirsutula Hook. & Arn. var. *subintegra* Steyerl., Ann. Missouri Bot. Gard. 21: 229. 1934. TYPE: U.S.A. California: Ventura Co., 2 mi. E of Ojai, 1 July 1933, *J. T. Howell 11414* (holotype, MO-1044105!; isotypes, CAS [barcode] 00123709 digital image!, CAS [barcode] 00123710 digital image!, F [barcode] 0050286F digital image!, K [barcode] 000250074 digital image!, LL [barcode] 00373592 digital image!, NY [barcode] 00169611 digital image!, US [barcode] 00008207 digital image!).

Grindelia rubricaulis DC. var. *permixta* Steyerl., Ann. Missouri Bot. Gard. 21: 582. 1934, syn. nov. TYPE: U.S.A. California: Alameda Co., San Leandro, 22 July 1929, *J. T. Howell 4352* (holotype, CAS [barcode] 00123675 digital image!).

Perennial subshrubs, 0.35–0.4 m; stems 1 to several, erect, not ramified or with few branches, hirsute to lanuginous. Leaves herbaceous or subcoriaceous, sessile, blade apex acute or obtuse, margin entire or toothed, teeth ending in a sclerotic tip, simple hairs and sessile glandular trichomes present on both blade surfaces; basal leaves narrowly obovate, 9–10 × 1–2 cm, attenuate into a pseudopetiole, blade apex obtuse; cauline leaves oblong to oblong-spatulate, 5–10 × 0.7–2 cm, clasping; blade apex acute or obtuse. Heads radiate, pedunculate, 3.5–4 cm diam.; involucre hemispheric to hemispheric-campanulate, resinous, 9–15 × 20–25 mm; phyllaries in 4 to 8 unequal series, graduated, subulate, with simple hairs and sessile glandular trichomes; the outer bracts narrowly triangular, 5 mm, erect or scarcely reflexed, with few sessile glandular trichomes; the middle bracts narrowly ovate, 7 mm; the upper phyllaries ovate, 10 mm, erect. Ray florets 20 to 48; tube glabrous, ligule narrowly elliptic, 8–15 mm, apex entire, lobed or shortly toothed. Disk florets with corolla 5–6 mm, with a gradually ampliate throat. Achenes dull brown to dark brown, elliptic, 4-angled, 3–4 mm, smooth or striate, apex forming a

crown; pappus of 2 to 4 subulate scales, 3.5–4 mm, somewhat curved, smooth to barbellulate. Chromosome numbers: $2n = 12$ (Raven et al., 1960: 126, sub *G. hirsutula* and *G. rubricaulis* var. *permixta*; Lane, 1993: 272); $2n = 24$ (Lane, 1993: 272).

Iconography. Steyermark (1934: 579, fig. 35); Lane (1993: 279).

Distribution and habitat. *Grindelia hirsutula* grows on sandy and clay soils, in slopes and roadsides, at 900 m, in California (U.S.A).

Phenology. *Grindelia hirsutula* flowers from May to September.

Etymology. The specific epithet is taken from the Latin “hirsutus,” meaning “covered by straight ascending trichomes.”

Common name. Hairy gumweed (<<http://plants.usda.gov/>>).

Discussion. *Grindelia hirsutula* is characterized by its radiate heads, 3.5–4 cm diameter, with subulate phyllaries arranged in graduated series. The taxon is related to *G. villarrealii* G. L. Nesom, with which it shares a nonrhizomatous habit and leaves with sessile glandular trichomes not in pits. *Grindelia hirsutula* differs by its larger-sized heads (vs. 1.3–1.5 cm diameter in *G. villarrealii*), the absence of stipitate glandular trichomes, and non-tuberculate achenes.

Greene (1883) noted that in the collections at CAS, two different species are included under the name *Grindelia hirsutula*: one a more slender taxon, with smaller heads and shorter phyllaries, and the other stout, with long, spreading phyllaries. Later he described the stout taxon under the name *G. patens*, a species different from *G. hirsutula*, but matching in part the concept of *G. hirsutula* from Gray. Nevertheless, Steyermark (1934) considered *G. patens* a variety of *G. hirsutula*, and Lane (in sched., 1993) considered the type of *G. patens* a hybrid between *G. hirsutula* var. *hirsutula* and *G. stricta* var. *platyphylla* (Greene) M. A. Lane.

The species *Grindelia rubricaulis*, *G. pacifica*, and *G. patens* were established, based on characters with continuous variation within this species.

Four forms were described by Steyermark (1934) within *Grindelia hirsutula* and represent variability within its species concept. Four varieties were further established by Steyermark (1934): three within *G. hirsutula* as variety *brevisquama*, variety *calva*, and variety *subintegra* and a fourth associated with another species as *G. rubricaulis* var. *permixta*. These eight infraspecific names for Steyermark all newly

synonymize as no more than variation seen within the species *G. hirsutula*. Similarly, Strother and Wetter (2006) included some 30 names within their synonymy of *G. hirsutula* (including *G. rubricaulis*), some of which are accepted as independent taxonomic species herein, while others synonymize elsewhere in the present paper. In the broad concept of *G. hirsutula* recognized by Strother and Wetter, the taxon has a wide distribution area in Canada and most of the United States.

Additional specimens examined. U.S.A. **California:** Alameda Co., Albany Hills in Albany betw. San Pablo Ave. & Interstate 80, *B. Ertter 10142* (NY); Marin Co., Sausalito, *A. Eastwood 280* (MO); San Bruno Hills, *A. D. E. Elmer 4267* (MO); along railroad N of San Rafael, *J. T. Howell 21491* (MO); Sausalito Hills, *J. T. Howell 11455* (MO), *J. T. Howell 11456* (MO); Sausalito Hills, *J. T. Howell 11457* (MO); White’s Hill, betw. Fairfax & Woodacre, *J. T. Howell 11463* (MO); Sausalito Hills, Napa Co., E side of Napa Valley, near Stags Leap, *J. T. Howell 11394* (MO); San Francisco Co., San Luis Obispo, summit of Cuesta Paso, *J. T. Howell 11415* (MO); hills of Visitación Valley, *J. T. Howell 11436* (MO); near San Francisco, 1866, *A. Kellogg s.n.* (MO-130116); San Mateo Co., Spring Valley Lake, *D. Demaree 10424* (MO); San Francisco Bay, *D. Demaree 10523* (MO); above Crystal Springs on Half Moon Bay Rd., *A. A. Heller 8575* (MO); San Andreas Lake, open Clay Hills, *L. S. Rose 33221* (MO); Santa Clara Co., foothills W of Los Gatos, *A. A. Heller 7461* (PH); Sonoma Co., 4 mi. from Santa Rosa on rd. to Sonoma, *J. T. Howell 4304* (MO); 8 mi. W of Petaluma, *J. T. Howell 5223* (MO).

14. *Grindelia hirtella* (B. L. Rob. & Greenm.) Adr. Bartoli & Tortosa, comb. et stat. nov. Basionym: *Grindelia squarrosa* (Pursh) Dunal var. *hirtella* B. L. Rob. & Greenm., Amer. J. Sci. Arts, ser. 3, 50: 153. 1895. *Grindelia inuloides* Willd. var. *hirtella* (B. L. Rob. & Greenm.) G. L. Nesom, Phytologia 68: 326. 1990. TYPE: Mexico. Oaxaca: Las Sedas, 6000 ft., 16 Aug. 1894, *C. G. Pringle 4805* (holotype, GH [barcode] 00008457 digital image!; isotypes, BKL [barcode] 00000146 digital image!, GOET [barcode] 001588 digital image!, M [barcode] 0029681 digital image!, MEXU-33270 digital image!, MO-130334!, NY [barcode] 169643!, P [barcode] 00742808 digital image!, PH-47868!, TEX [barcode] 00000478 digital image!). Figure 6.

Biannual or perennial subshrubs, 0.15–1 m; stems 1, rarely 2 or more, erect, ramified, pubescent. Leaves subcoriaceous, sessile, oblong, elliptic, or obovate, 2–5 × 1–2 cm, clasping, auriculate; blade apex obtuse, margin entire, crenate, serrate or toothed, teeth ending in a sclerotic tip, simple hairs scattered, sessile glandular trichomes present on both blade surfaces. Heads radiate, pedunculate, 1.5–2 cm diam.; involucre hemispheric to hemispheric-

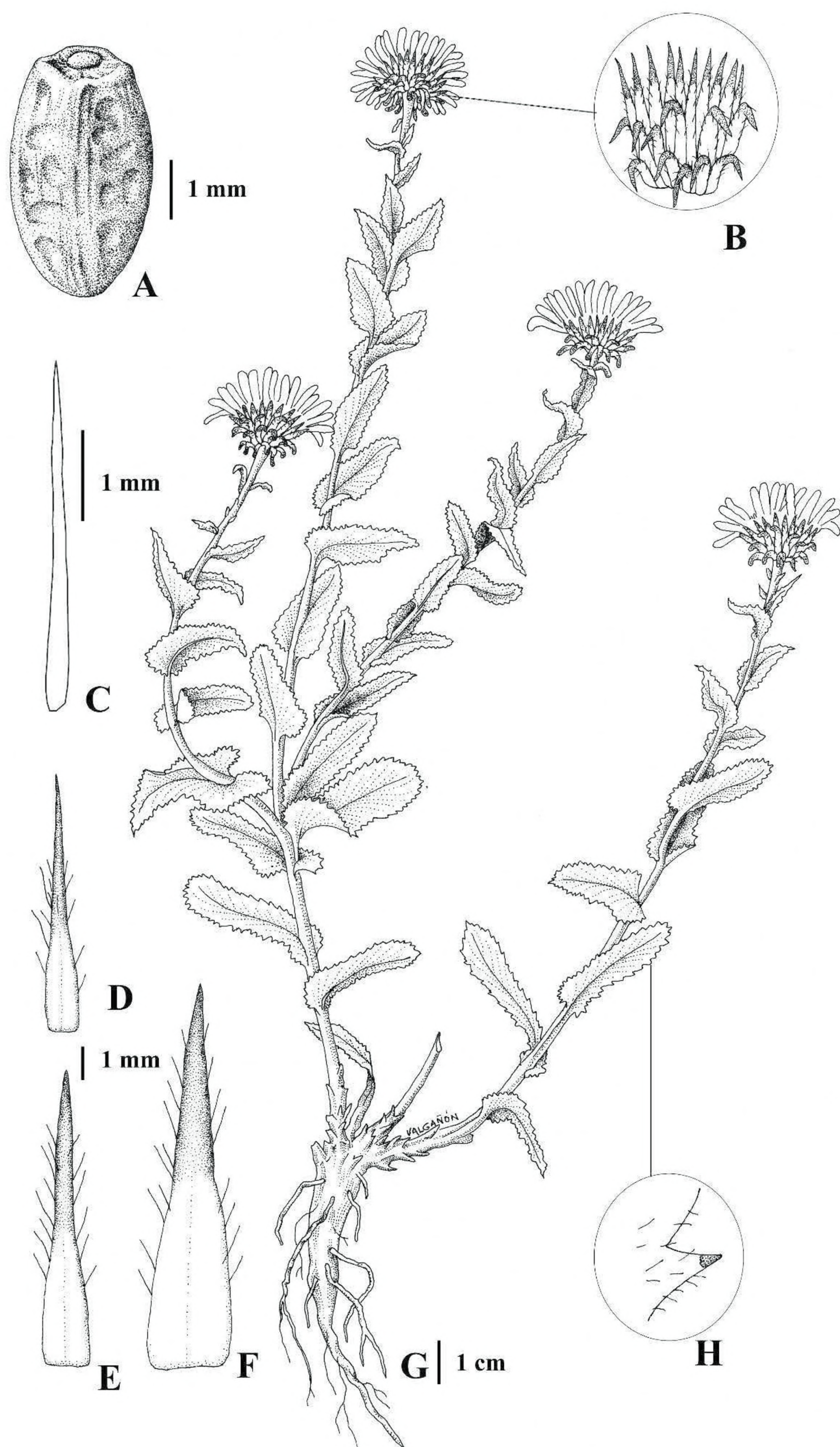


Figure 6. *Grindelia hirtella* (B. L. Rob. & Greenm.) Adr. Bartoli & Tortosa. —A. Achene, showing the tuberculate surface, subquadrate. —B. Involucre, with phyllaries in four to six series. —C. Pappus, showing one of two or three bristles. D–F. Representative phyllaries. —D. Outer series. —E. Middle series. —F. Inner series. —G. Fertile habit. —H. Leaf tooth, ending in a sclerotic tip, with surfaces showing sessile glandular trichomes. Drawn from C. L. Smith 686 (MO).

campanulate, resinous, 6–10 × 10–28 mm; phyllaries in 4 to 6 unequal series, graduated, acuminate, linear-elliptic to narrowly ovate, 4–12 mm, spreading or reflexed; acumen linear or narrowly triangular, subterete to terete, 4 mm, straight to spreading, with sessile glandular trichomes. Ray florets 20 to 40; tube

glabrous, ligule elliptic, 5–11 mm, apex entire or toothed. Disk florets with corolla 4–6 mm, with a gradually ampliate throat. Achenes dull brown, subquadrate, 2–2.5 mm, tuberculate, apex truncate; pappus of 2 or 3 bristles, 3–3.5 mm, smooth. Chromosome number not known.

Distribution and habitat. *Grindelia hirtella* grows on calcareous hillsides, from 1200 to 1800 m, in the states of Oaxaca and Puebla (Mexico).

Phenology. *Grindelia hirtella* flowers from January to September.

Etymology. The specific epithet is taken from the Latin “hirtus,” which refers to being covered with long, weak hairs.

Discussion. Diagnostic features of *Grindelia hirtella* include leaves with teeth that end in a sclerotic tip, with sessile glandular trichomes present on both blade surfaces, these trichomes not in pits; spreading or reflexed phyllaries arranged in graduated series, with a phyllary with subterete or terete acumen, and tuberculate achenes. The taxon was originally described as a variety of *G. squarrosa*, but in this species the teeth of the leaves end in a group of sessile glandular trichomes, the glandular trichomes of the epidermis are in pits, and the achenes are not tuberculate. Nesom (1990) considered *Grindelia hirtella* a variety of *G. inuloides*; however *G. hirtella* is distinguished by its phyllaries arranged in unequal series, in contrast to the subequal series in *G. inuloides*; in addition, the heads are smaller (1.5–2 cm diameter vs. 2.5–3 cm diameter) and the achenes are subquadrate and tuberculate (vs. elliptic and slightly flattened, to 3- or 4-angled, smooth or with transverse incisions).

Additional specimens examined. MEXICO. **Oaxaca:** 8 km NE de San Gabriel, *J. González-Martínez 102* (MO); Oaxaca Valley, *C. L. Smith 686* (MO). **Puebla:** vic. of San Luis Tultitlanapa, near Oaxaca, *C. A. Purpus 2514* (MO).

15. *Grindelia humilis* Hook. & Arn., Bot. Beechey Voy., 147. 1833. TYPE: U.S.A. California: [probably from San Francisco Bay or Monterey Bay; see Gray, *Geol. Surv. Calif. Bot.* 1: 304. 1876.] s.d., *Botany Beechey Voyage s.n.* (holotype, K [barcode] 250077 digital image!; isotype, UC [barcode] 292621 digital image!).

Perennial shrubs or subshrubs, 0.3–0.6(–1.5) m; stems 1 to several, erect or creeping, not ramified or with few branches, glabrous or hairy. Leaves succulent, sessile; blade apex acute or obtuse, margin entire or toothed, teeth ending in a sclerotic tip, simple hairs occasionally present along the nerves or at the margin, sessile glandular trichomes present on both blade surfaces, superficial or in pits; basal leaves narrowly obovate, 13–19 × 2–3 cm, attenuate into a pseudopetiole; blade apex acute or obtuse; cauline leaves linear to oblong, 5–9 × 0.8–2 cm, clasping, auriculate; blade apex acute. Heads radiate,

pedunculate, 3.5–5 cm diam.; involucre hemispheric to hemispheric-campanulate, resinous, 12–20 × 17–30 mm; phyllaries in 4 or 5 subequal series, acuminate, elliptic to narrowly ovate, 8–15 mm, erect or spreading, glabrous or with simple hairs, margin entire; acumen triangular, flat or subterete, as long as the base, with sessile glandular trichomes. Ray florets 20 to 60; tube glabrous, ligule narrowly elliptic, 18–23 mm, apex entire. Disk florets with corolla 5–6 mm, with an abruptly ampliate throat. Achenes elliptic, light brown, 4-angled, 3–5 mm, smooth or rugose, apex truncate or oblique; pappus of 2 to 5 subulate scales, 2.5–3 mm, curved, smooth to barbellulate.

Etymology. The specific epithet is taken from the Latin “humilis” for “low-growing,” which refers to the size of the plant.

Discussion. *Grindelia humilis* is characterized by acuminate phyllaries, arranged in subequal, four or five series, with a triangular acumen as long as the phyllary base. The marginal teeth of its leaves end in a sclerotic tip, and the pappus consists of curved, subulate scales. The taxon is related to *G. greenmanii* and *G. inuloides*, sharing leaf teeth that end in a sclerotic tip and phyllaries arranged in subequal series. These two latter taxa differ by the acumen of the phyllaries. The acumen is also triangular but shorter in *G. greenmanii*, less than the basal segment; the acumen is narrower and linear-elliptic to narrowly ovate in *G. inuloides*. Both these species share a pappus of bristles, in contrast to the subulate scales seen in *G. humilis*.

The type specimen for *Grindelia humilis* consists of only the apical portion of the plant and lacks the basal stem and leaves. This may be why Hooker and Arnott described the species as a dwarf herb with narrowly linear and entire leaves.

Lane (1992) and Strother and Wetter (2006) included *Grindelia humilis* as a synonym of *G. hirsutula*, but the latter species differs from *G. humilis* by its subulate phyllaries arranged in graduated series.

Two varieties are recognized for *Grindelia humilis* and can be distinguished by the following couplet.

- 1a. Stems erect; leaves with apex acute to obtuse, glandular trichomes not in pits
..... 15a. *G. humilis* var. *humilis*
- 1b. Stems creeping; leaves with apex rounded, glandular trichomes always in pits
..... 15b. *G. humilis* var. *platyphylla*

15a. *Grindelia humilis* var. *humilis*.

Grindelia stricta DC., *Prodr. (DC.)* 7: 278. 1838, syn. nov.
TYPE: U.S.A. Alaska: Portum Mulgrave, *T. Haenke*

- s.n.* (holotype, “herb. Haenke” not seen; isotypes, G-DC, IDC microfiche!, UC [barcode] 292722 digital image!).
- Grindelia robusta* Nutt., Trans. Amer. Philos. Soc., n.s. 7: 314. 1840, syn. nov. *Grindelia rubricaulis* DC. var. *robusta* (Nutt.) Steyerl., Ann. Missouri Bot. Gard. 21: 227. 1934. TYPE: U.S.A. California: San Pedro, *T. Nuttall s.n.* (holotype, PH [barcode] 01085478, p.p. [fertile stem at left]!; isotype, GH [barcode] 00037708!).
- Grindelia cuneifolia* Nutt., Trans. Amer. Philos. Soc. 7: 315. 1841, syn. nov. *Grindelia robusta* Nutt. var. *angustifolia* A. Gray, Bot. California [W. H. Brewer], 304. 1876, nom. nov. for *Grindelia cuneifolia* Nutt. *Grindelia stricta* DC. var. *angustifolia* (A. Gray) M. A. Lane, Novon 2(3): 217. 1992. TYPE: U.S.A. California: Santa Barbara Co., Santa Barbara, s.d., *T. Nuttall s.n.* (holotype, BM [barcode] 001025306 digital image!; isotype, GH [barcode] 00037687!).
- Grindelia latifolia* Kellogg, Proc. Calif. Acad. Sci. 5: 36. 1873, syn. nov. *Grindelia robusta* Nutt. var. *latifolia* (Kellogg) Jeps., Man. Fl. Pl. Calif. [Jepson], 1020. 1925. *Grindelia rubricaulis* DC. var. *latifolia* (Kellogg) Steyerl., Ann. Missouri Bot. Gard. 21: 227. 1934. TYPE: U.S.A. California: Santa Barbara Co., Santa Rosa Island, 1872–1873, *W. G. W. Harford s.n.* (holotype, GH [barcode] 00008430!).
- Grindelia oregana* A. Gray, Syn. Fl. N. Amer. 1(2): 118. 1884, syn. nov. TYPE: U.S.A. Washington: Fidalgo Island, 1838, *D. Lyall s.n.* (holotype, GH [barcode] 00037706!).
- Grindelia hendersonii* Greene, Pittonia 2: 18. 1889, syn. nov. *Grindelia stricta* DC. var. *hendersonii* (Greene) Steyerl., Ann. Missouri Bot. Gard. 21: 562. 1934. TYPE: U.S.A. Washington: rocky banks of Lummi Island, Bellingham Bay and S shore of the Gulf of Georgia, 5 July 1888, *L. F. Henderson 1676* (holotype, NDG-53594 digital image!; isotype, GH [barcode] 00037691!).
- Grindelia lanata* Greene, Pittonia 2: 290. 1892, syn. nov. *Grindelia stricta* DC. var. *lanata* (Greene) Steyerl., Ann. Missouri Bot. Gard. 21: 563. 1934. TYPE: Canada. British Columbia: Oak Bay, Vancouver Island, 18 June 1887, *J. Macoun s.n.* (holotype, NDG-53607 digital image!; isotype, BM [barcode] 001025307 digital image!).
- Grindelia paludosa* Greene, Man. Bot. San Francisco 172: 1894, syn. nov. *Grindelia cuneifolia* (Nutt.) var. *paludosa* (Greene) Jeps., Fl. W. Calif. [Jepson], 556. 1901. TYPE: U.S.A. California: Suisun Marsh, 29 Sep. 1889, *E. L. Greene s.n.* (holotype, NDG-53622 digital image!; isotype, NY [barcode] 00008410!).
- Grindelia macrophylla* Greene, Pittonia 3: 297. 1898, syn. nov. *Grindelia stricta* DC. var. *macrophylla* (Greene) Steyerl., Ann. Missouri Bot. Gard. 21(3): 561. 1934. *Grindelia integrifolia* DC. var. *macrophylla* (Greene) Cronquist, Vasc. Pl. Pacific NorthW. [C. L. Hitchcock & al.] 5: 207. 1955. TYPE: Canada. British Columbia: Vancouver, July 1890, *E. L. Greene s.n.* (holotype, NDG-53613 digital image!; isotype, NDG-53614 digital image!).
- Grindelia robusta* Nutt. var. *davyi* Jeps., Fl. W. Calif. [Jepson], 554. 1901, as “Davyi,” syn. nov. *Grindelia camporum* Greene var. *davyi* (Jeps.) Steyerl., Ann. Missouri Bot. Gard. 21: 534. 1934. *Grindelia hirsutula* Hook. & Arn. var. *davyi* (Jeps.) M. A. Lane, Novon 2(3): 216. 1992. TYPE: U.S.A. California: Berkeley, Peralta Park, 10 June 1896, *J. Burt Davy s.n.* (holotype, JEPS [barcode] 21750 digital image!; isotypes, UC [barcode] 32128 digital image!, UC [barcode] 32135 digital image!).
- Grindelia integrifolia* DC. var. *aestivalis* J. K. Henry, Fl. S. Brit. Columbia, 291. 1915, syn. nov. TYPE: Canada. British Columbia: near shore, Oak Bay, Victoria, 26 July 1913, *J. K. Henry s.n.* (holotype, NY [barcode] 00169607!).
- Grindelia integrifolia* DC. var. *autumnalis* J. K. Henry, Fl. S. Brit. Columbia, 291. 1915, syn. nov. TYPE: Canada. British Columbia: Victoria, Vancouver Island, 7 July 1913, *J. K. Henry s.n.* (holotype, CAS [barcode] 00123714 digital image!; isotype, CAS [barcode] 00123715 digital image!).
- Grindelia collina* J. K. Henry, Fl. S. Brit. Columbia, 291. 1915, syn. nov. *Grindelia stricta* DC. var. *collina* (J. K. Henry) Steyerl., Ann. Missouri Bot. Gard. 21: 564. 1934. TYPE: Canada. British Columbia: dry hill, Thetis Lake, near Victoria, Vancouver Island, 18 July 1915, *J. K. Henry s.n.* (holotype, NY [barcode] 169600!; isotype, CAS [barcode] 00123702 digital image!).
- Grindelia oregana* A. Gray subsp. *wilkesiana* Piper, Fl. N.W. Coast [Piper & Beattie], 363. 1915, syn. nov. TYPE: U.S.A. Washington: Gray’s Harbor Co., betw. Gray’s Harbor & Satchap River, *Wilkes Expedition s.n.* (holotype, NY [barcode] 8408!).
- Grindelia andersonii* Piper, Proc. Biol. Soc. Wash. 31: 77. 1918, syn. nov. *Grindelia stricta* DC. var. *andersonii* (Piper) Steyerl., Ann. Missouri Bot. Gard. 21: 559. 1934. TYPE: Canada. British Columbia: Saanich Arm, Vancouver Island, 5 July 1917, *G. R. Anderson s.n.* (holotype, US [barcode] 00008202 digital image!).
- Grindelia rubricaulis* DC. var. *interioris* Jeps., Man. Fl. Pl. Calif. [Jepson], 1021, syn. nov. *Grindelia camporum* Greene var. *interioris* (Jeps.) Steyerl., Ann. Missouri Bot. Gard. 21: 538. 1934. TYPE: U.S.A. California: Calaveras Co., Copperopolis, Mokelumne Hill, 18–30 May 1895, *J. Burt Davy 1383* (holotype, UC [barcode] 32130 digital image!).
- Grindelia aggregata* Steyerl., Ann. Missouri Bot. Gard. 21: 566. 1934, syn. nov. TYPE: Canada. British Columbia: Victoria, 27 Aug. 1903, *J. W. Congdon s.n.* (holotype, MO [barcode] 714911!).
- Grindelia camporum* Greene f. *foliacea* Steyerl., Ann. Missouri Bot. Gard. 21: 534. 1934, syn. nov. [described under *Grindelia camporum* var. *interioris*]. TYPE: U.S.A. California: Solano Co., clay hill, 1 mi. from Vacaville on rd. to Elmira, 30 May 1930, *J. T. Howell 5201* (holotype, CAS [barcode] 00123703 digital image!; isotype, GH [barcode] 00037685!).
- Grindelia humilis* Hook. & Arn. f. *pubescens* Steyerl., Ann. Missouri Bot. Gard. 21: 527. 1934, syn. nov. TYPE: U.S.A. California: Napa Co., upper edge of tidal flat, Cuttings Wharf, on Napa River, 8 Oct. 1932, *J. T. Howell 10805* (holotype, CAS [barcode] 00123711 digital image!; isotypes, GH [barcode] 00037685!, MO [barcode] 714095!).
- Grindelia humilis* Hook. & Arn. f. *reflexa* Steyerl., Ann. Missouri Bot. Gard. 21: 526. 1934, syn. nov. TYPE: U.S.A. California: Oakland, salt marsh, 15 Nov. 1883, *E. L. Greene s.n.* (holotype, GH [barcode] 00037699!).
- Grindelia stricta* DC. var. *aestuarina* Steyerl., Ann. Missouri Bot. Gard. 21: 560. 1934, syn. nov. TYPE: U.S.A. Washington: tide lands, Marysville, June 1928,

J. M. Grant s.n. (holotype, RM [barcode] 0001129 digital image!).

Grindelia stricta DC. f. *elongata* Steyer., Ann. Missouri Bot. Gard. 21: 560. 1934, syn. nov. [described under *Grindelia stricta* var. *aestuarina*]. TYPE: Canada. British Columbia: margin of arm of Victoria Harbor, 3 mi. from Victoria on Island hwy., Vancouver Island, 27 July 1931, *J. T. Howell* 7545 (holotype, CAS [barcode] 00123677 digital image!; isotypes, CAS [barcode] 188501 digital image!, MO [barcode] 714912!).

Grindelia blackei Steyer., Ann. Missouri Bot. Gard. 21: 567. 1934, syn. nov. *Grindelia stricta* DC. subsp. *blakei* (Steyer.) D. D. Keck, Aliso 4: 102. 1958. TYPE: U.S.A. California: Humboldt Co., Eureka, salt meadows along canal, 9 Aug. 1931, *J. A. Moore* & *J. A. Steyermark* 3686 (holotype, MO [barcode] 714076!; isotypes, MO [barcode] 714091!, UC [barcode] 520410 digital image!).

Stems erect. Leaves with apex acute to obtuse, blade with few sessile glandular trichomes. Chromosome numbers: $2n = 12$ (Raven et al., 1960: 126, sub *Grindelia rubricaulis* var. *robusta*; Pinkava & Keil, 1977: 681, sub *G. latifolia*; Lane, 1993: 274, sub *G. stricta* var. *angustifolia*; Lane & Li, 1993: 542, sub *G. hirsutula* var. *davyi*, *G. stricta* var. *stricta*, *G. stricta* var. *angustifolia*; Semple et al., 1989: 302, sub *G. stricta*; Chambers et al., 1998: 19, sub *G. stricta*); $2n = 24$ (Lane, 1993: 274, sub *G. stricta* var. *angustifolia*).

Iconography. Lane (1993: 279), sub nom *Grindelia stricta*.

Distribution and habitat. *Grindelia humilis* var. *humilis* grows along seashores, sand dunes, and lowlands, from 0 to 200 m, from southern Alaska (U.S.A.) and southwestern Canada to California (U.S.A.).

Phenology. *Grindelia humilis* var. *humilis* flowers from May to November.

Common name. Oregon gumweed (<<http://plants.usda.gov/>>, sub nom. *Grindelia stricta* var. *platyphylla*).

Discussion. The high variation in the shape of leaves and in the general pubescence of the plants for *Grindelia humilis* accounts for the significant number of synonyms. The types of *G. robusta* and *G. stricta* share diagnostic characters with *G. humilis* var. *humilis*, including erect stems, leaves with marginal teeth that end in a sclerotic tip, and pedunculate heads with phyllaries with an acuminate involucre, arranged in subequal series, with a triangular acumen as long as the phyllary base. In the case of Nuttall's species *G. cuneifolia*, the type seems to be an abnormal specimen with sessile heads (see Steyermark, 1934: 593). The name *cuneifolia* was replaced

by Gray with the varietal name *angustifolia* under *G. robusta*.

Most of the synonyms for *Grindelia humilis* and included here were previously considered at lower rank by Steyermark (1934), as varieties of *G. camporum*, *G. rubricaulis* (this species refers to *G. hirsutula* in the current paper), or *G. stricta* (referred to *G. humilis* herein). *Grindelia humilis* and several other names (*G. blackei*, *G. macrophylla*, *G. paludosa*, *G. robusta*, *G. robusta* var. *davyi*, and *G. stricta*) were relegated to the synonymy of *G. hirsutula* by Strother and Wetter (2006). Nevertheless, the taxon recognized herein as *G. humilis* can be distinguished from *G. camporum* by its phyllaries in subequal series, a triangular acumen (vs. a graduated phyllary series with a terete or subterete acumen in *G. camporum*); the corolla of disk florets with an abruptly ampliate throat (vs. gradually ampliate); and the achenes elliptic, 4-angled (vs. broadly elliptic and 2- or 3-angled). In *G. hirsutula*, the phyllaries are subulate and arranged in graduated series, and the corolla of disk florets presents a gradually ampliate throat.

Lane (1992) considered the type of *Grindelia robusta* to be a hybrid between *G. hirsutula* var. *hirsutula* and a variety of *G. stricta*. The type of *G. camporum* f. *foliacea* (Lane, in sched.) was annotated as a hybrid between *G. hirsutula* var. *davyi* and *G. hirsutula* var. *hirsutula*, that of *G. humilis* var. *pubescens* (Lane, in sched.) a hybrid between *G. camporum* var. *camporum* and *G. stricta* var. *angustifolia*, that of *G. latifolia* (Lane, in sched.) a hybrid between *G. camporum* var. *bracteosa* (J. T. Howell) M. A. Lane and *G. stricta* var. *platyphylla* [= *G. humilis* var. *platyphylla* herein], that of *G. paludosa* (Lane, in sched., NY and UC) a hybrid from *G. camporum* var. *camporum* × *G. stricta* var. *angustifolia*, *G. robusta* (Lane, in sched., GH) a hybrid from *G. hirsutula* var. *hirsutula* × *G. stricta* var. *platyphylla*, and finally that of *G. hirsutula* var. *davyi* may be a possible derivative of *G. hirsutula* var. *hirsutula* × *G. camporum* (Lane, 1993).

Additional specimens examined. CANADA. **British Columbia:** Vancouver Island, vic. of Victoria, *J. Macoun* 420 (MO); Kitsap Co., Keyport, *W. J. Eyerdam* 1179 (GH); Skagit Co., Rosario Beach, *W. J. Eyerdam* 1302 (GH); strait of Juan de Fuca, near Victoria, Vancouver Island, *R. C. Rollins* & *T. S. Chambers* 2691 (GH); Sidney, Vancouver Island, *T. M. C. Taylor* 3009 (GH). U.S.A. **California:** Amador Co., *G. Hansen* 172 (MO), *G. Hansen* 1672 (MO); Butte Co., Little Chico Creek, *R. M. A.* 725 (MO-130117); Table Mtn., olive ranch, N of Oroville, *A. A. Heller* 10780 (MO); E side of turn off upper Bidwell Park to Bear Hole, *D. Isle* 478 (MO); Plumas Natl. Forest on state rd. 23N06, 1.5 mi. N of jct. with hwy. 70, *H. H. Schmidt*, *M. Merello* & *L. Woodruff* 864 (MO); Calaveras Co., Jenny Lind, dry hillside, *E. E. Stanford* 969 (MO); Contra Costa Co., tidal flat at mouth of Rodeo Creek, 8 Oct. 1932, *J. T. Howell* 10796

(MO); Humboldt Co., salt marsh at Eureka, *A. A. Heller 1840* (MO); along hwy. near crossing of Eel River, S of Garberville, *A. A. Heller 13764* (MO); NW of Eureka on W side of Arcata Bay, just N of CA state hwy. 255 bridge on Samoa Peninsula along Vance Ave., *M. A. Lane 3138* (MO); Kings Co., Fort Lawton, edge of saltwater marsh, 25 July 1937, *W. J. Eyerdam s.n.* (MO-1158524); Lincoln Co., Sacramento Valley, 1 mi. NW of Placer, *C. B. Wolf 8619* (MO); Marin Co., sandy flats, Point Reyes Peninsula, *J. T. Howell 11710* (MO); Mt. Tamalpais, dry slopes, *L. S. Rose 33315* (MO); Mendocino Co., bluff 1 mi. N of Fort Bragg, 10 Aug. 1938, *A. A. Heller s.n.* (MO-1162225); Napa Co., Mt. St. Helena, *J. T. Howell 5346* (MO); Nevada Co., near Nevada city, *A. A. Heller 8117* (MO); San Francisco, vic. of Berkeley, *H. A. Walker 430* (PH); San Mateo Co., S San Francisco, *J. A. Moore & J. A. Steyermark 3684* (MO); Santa Clara Co., Alviso, *E. B. Bartram s.n.* (PH), 17 Aug. 1906, *C. S. Williamson s.n.* (PH); Solano Co., Suisun Marsh along railroad near Suisun, *A. A. Heller 7542* (MO), 29 Sep. 1889, *E. L. Greene s.n.* (MO-738819); salt marsh at Suisun, *J. T. Howell 11723* (MO); Tubbs Island, *H. E. Parks & S. T. Parks 0411* (MO, PH); Suisun, *L. S. Rose 33367* (MO); Sonoma Co., marsh W of creek N of Santa Rosa, *A. A. Heller 5810* (MO); The Geysers, *E. Marcus & A. M. Jones 29142* (MO); Sonoma, *L. S. Rose 40364* (MO); Tuolumne Co., Sierra Nevada, along rd. from Twain Harte to Sonora, *A. M. Alexander & L. Kellogg 3712* (MO); Yolo Co., near Madison, *A. A. Heller & H. E. Brown 5578* (MO). **Oregon:** Lane Co., Florence, *L. F. Henderson 13987* (PH); lagoon shores at mouth of Siuslaw River, 7 Sep. 1911, *Gorman s.n.* (PH); Tillamook Co., Tillamook Bay, *L. F. Henderson 433* (MO), Garibaldi, *M. E. Peck 13359* (PH); **Washington:** Clallam Co., Mora, sea beach, *G. N. Jones 3442* (MO); Clallam Co., Port Angeles, *J. W. Thompson 7855* (MO, PH); King Co., Seattle, July 1915, *G. N. Friberg s.n.* (MO-813677); Seattle, on beach, 24 Sep. 1934, *G. N. Jones s.n.* (MO-1251042); Seattle, Sep. 1929, *G. B. Rigg s.n.* (MO-979122); Seattle, Oct. 1910, *S. M. Zeller s.n.* (MO-813515); Argyle, San Juan Island, *S. M. Zeller & E. B. Zeller 956* (MO); Kitsap Co., Manitou Beach, on back beach, *W. J. Eyerdam 1150* (MO); Pierce Co., shores of Puget Sound near Steilacoom, *J. W. Thompson 9959* (MO); San Juan Co., Orcas Island, 4 July 1935, *W. J. Eyerdam s.n.* (MO-1153051); beach Three Tree Point, near Seattle, 23 Sep. 1937, *G. N. Jones s.n.* (MO-1251044); Skagit Co., *J. W. Thompson 10091* (MO); Thurston Co., salt marsh bordering head of Mud Bay, ca. 5 mi. W of Olympia, *F. G. Meyer 1588* (MO, PH).

15b. *Grindelia humilis* var. *platyphylla* (Greene)

Adr. Bartoli & Tortosa, comb. nov. Basionym: *Grindelia robusta* Nutt. var. *platyphylla* Greene, Pittonia 2: 289. 1892. *Grindelia rubricaulis* DC. var. *platyphylla* (Greene) Steyererm., Ann. Missouri Bot. Gard. 21: 227. 1934. *Grindelia latifolia* Kellogg subsp. *platyphylla* (Greene) D. D. Keck, Aliso 4: 102. 1958. *Grindelia stricta* DC. var. *platyphylla* (Greene) M. A. Lane, Novon 2: 217. 1992. TYPE: U.S.A. California: Monterey Co., Pacific Grove, July 1892, *M. A. Howe s.n.* (lectotype, designated by Lane [1992: 217], UC [barcode] 32131 digital image!; isolectotype, UC [barcode] 32132 [locality only as "Monterey"] digital image!).

Grindelia rubricaulis DC. var. *maritima* Greene, Pittonia 2: 289. 1892, syn. nov. *Grindelia robusta* Nutt. var. *maritima* (Greene) Jeps., Fl. W. Calif. [Jepson], 554. 1901. *Grindelia maritima* (Greene) Steyererm., Ann. Missouri Bot. Gard. 21: 576. 1934. *Grindelia hirsutula* Hook. & Arn. var. *maritima* (Greene) M. A. Lane, Novon 2: 216. 1992. TYPE: U.S.A. California: Point Lobos, 12 Aug. 1892, *E. L. Greene s.n.* (holotype, NDG 53637 digital image!; isotype, UC [barcode] 32144 digital image!).

Grindelia venulosa Jeps., Man. Fl. Pl. Calif. [Jepson], 1021. 1925, syn. nov. *Grindelia stricta* DC. f. *venulosa* (Jeps.) Steyererm., Ann. Missouri Bot. Gard. 21: 558. 1934. *Grindelia stricta* DC. subsp. *venulosa* (Jeps.) D. D. Keck, Aliso 4: 102. 1958. TYPE: U.S.A. California: Humboldt Co., in quicksand on seashore near Big Flat, 1867, *H. N. Bolander 6493* (holotype, JEPS [barcode] 2620 digital image!; isotype, US [barcode] 00323468 digital image!).

Grindelia arenicola Steyererm., Ann. Missouri Bot. Gard. 21: 229. 1934, syn. nov. TYPE: U.S.A. California: Mendocino Co., Mendocino coastal plain, 4.5 mi. N of Ft. Bragg, 14 Sep. 1930, *J. T. Howell 5473* (holotype, CAS [barcode] 00123698 digital image!, xerox at BAA!; isotypes, GH [barcode] 00037683!, UC [barcode] 473548 digital image!).

Grindelia arenicola Steyererm. var. *pachyphylla* Steyererm., Ann. Missouri Bot. Gard. 21: 596. 1934, syn. nov. TYPE: U.S.A. California, Mendocino Co., open coastal plain, 6 mi. S of Point Arena, 27 Sep. 1931, *J. T. Howell 8106* (holotype, CAS [barcode] 00123699 digital image!; isotypes, GH [barcode] 00037684!, MO [barcode] 714075!).

Grindelia arenicola Steyererm. f. *trichophora* Steyererm., Ann. Missouri Bot. Gard. 21: 596. 1934, syn. nov. [described under *Grindelia arenicola* var. *pachyphylla*]. TYPE: U.S.A. California: San Mateo Co., Half-moon Bay, 1913, *W. F. Schmitt s.n.* (holotype, US [barcode] 00008203 digital image!).

Grindelia maritima (Greene) Steyererm. f. *anomala* Steyererm., Ann. Missouri Bot. Gard. 21: 578. 1934, syn. nov. TYPE: U.S.A. California: Laguna Honda, San Francisco, 15 Sep. 1933, *J. T. Howell 11658* (holotype, MO-1044116!; isotype, CAS [barcode] 205557 digital image!).

Grindelia rubricaulis DC. f. *pubescens* Steyererm., Ann. Missouri Bot. Gard. 21: 589. 1934, syn. nov. [described under *Grindelia rubricaulis* var. *latifolia*]. TYPE: U.S.A. California: Monterey Co., betw. Lucia & Little Hot Springs, 14 June 1909, *K. Brandegees s.n.* (holotype, UC [barcode] 468770 digital image!; isotypes, CAS [barcode] 00123674 digital image!, CAS [barcode] 237886 xerox!).

Grindelia rubricaulis DC. f. *minor* Steyererm., Ann. Missouri Bot. Gard. 21: 589. 1934, syn. nov. [described under *Grindelia rubricaulis* var. *latifolia*]. TYPE: U.S.A. California: Santa Barbara Co., Casmalia sands, country adjacent to Santa Maria, 13 June–3 July 1906, *A. Eastwood 794* (holotype, GH [barcode] 00037711!; isotypes, CAS [barcode] 00123673 digital image!, US [barcode] 00008214 digital image!).

Grindelia rubricaulis DC. f. *villosa* Steyererm., Ann. Missouri Bot. Gard. 21: 590. 1934, syn. nov. [described under *Grindelia rubricaulis* var. *platyphylla*]. TYPE: U.S.A. California: Monterey Co., Pacific Grove, coast above Chinatown Point, 10 July 1905, *C. P. Smith 1016*

(holotype, GH [barcode] 00037712!; isotypes, MICH [barcode] 1107423 digital image!, US [barcode] 00344741 digital image!).

Grindelia stricta DC. var. *procumbens* Steyerl., Ann. Missouri Bot. Gard. 21: 559. 1934, syn. nov. TYPE: U.S.A. California: Humboldt Co., on sandy seashore at base of cliffs, 10 mi. N of Trinidad, 9 Aug. 1931, J. A. Moore & J. A. Steyermark 3687 (holotype, MO [barcode] 714077!; isotype, MO [barcode] 714078!).

Stems creeping. Leaves with apex rounded; sessile glandular trichomes always in pits. Chromosome numbers: $2n = 12$ [Raven et al., 1960: 126, sub *Grindelia arenicola*, *G. maritima*; Pinkava & Keil, 1977: 681, sub *G. latifolia* subsp. *platyphylla*]; $2n = 24$ (Lane, 1993: 274, sub *G. stricta* var. *platyphylla*).

Iconography. Lane (1993: 279), sub *Grindelia stricta* var. *platyphylla*.

Distribution and habitat. *Grindelia humilis* var. *platyphylla* has been collected on sand dunes and coastal bluffs, from 0 to 200 m, in California (U.S.A.).

Phenology. *Grindelia humilis* var. *platyphylla* has been collected in flower from the beginning of July to October.

Etymology. The name of this variety was taken from the Greek “platy-,” meaning “broad,” and “-phyllum,” meaning “leaf,” which refers to the shape of the leaves.

Discussion. Both varieties considered here have broad leaves (up to 2 cm wide).

Grindelia venulosa was merged in *G. stricta* (= *G. humilis* var. *humilis* in the present paper) by both Steyermark (1934) and Lane (1992), and was later considered a synonym of *G. hirsutula* by Strother and Wetter (2006). Lane also considered Steyermark’s coastal species *G. arenicola* within the variation associated with *G. humilis* var. *platyphylla*, but she associated the variety with *G. stricta* rather than *G. humilis*. In contrast to its synonymy here, Steyermark’s species *G. maritima* was included in *G. hirsutula* by both Lane (1992) and Strother and Wetter (2006). Greene (1892: 289) originally distinguished *G. rubricaulis* var. *maritima* by the pubescence and red stems of the plants. He distinguished two varieties for *Grindelia*, both along the Californian coast, and both varieties synonymize within the variability seen for *G. humilis* var. *platyphylla*. The phyllaries of *G. humilis* are subequal and acuminate, differing from those of *G. hirsutula*, which appear in a graduated series on the involucre, with subulate tips. In *G. humilis* var. *platyphylla*, the leaves present glandular trichomes in pits; leaves are not in pits in *G. hirsutula*.

Additional specimens examined. U.S.A. **California:** Humboldt Co., Big Lagoon, H. E. Parks 24190 (PH); Big Lagoon Park just W of US 101, P. Wilder 4375 (PH); Monterey Co., D. Demaree 9235a (MO); Moss Landing dock area near Marine Lab betw. ocean & hwy. 1, M. S. Taylor & E. Taylor 5189 (MO); San Luis Obispo Co., San Simeon Bay, E. Palmer 248 (PH); San Mateo Co., Pigeon Point, slopes by sea, D. D. Keck 2943 (MO); exposed slope near sea, Fort Winfield Scott, J. A. Moore & J. A. Steyermark 3685 (MO), 29 Aug. 1909, W. A. Setchell s.n. (MO), 21 Oct. 1936, s. coll. (PH); Santa Cruz Co., clay soil, 1/4 mi. back from ocean, 6 mi. N of Santa Cruz, J. T. Howell 10861 (MO).

16. *Grindelia integrifolia* DC., Prodr. (DC.) 5: 315. 1836. TYPE: U.S.A. Ex America Borealis p. occ. Hort. Soc. Hort. London, Aug. 1830, A. de Candolle s.n. (holotype, G-DC, IDC microfiche!; isotypes, CAS [barcode] 00123713 digital image! [holotype fragm. and photo], GH [barcode] 00037700!, P [barcode] 00742800 digital image!, UC [barcode] 292719 digital image!).

Perennial subshrubs, 0.5–0.8 m, with xylopodium; stem 1, erect, ramified, with stipitate glandular trichomes, simple hairs present or lacking. Leaves herbaceous, sessile, ovate-elliptic, $2-8 \times 0.7-3$ cm, clasping or base subcordate; blade apex acute or acuminate, margin entire, serrate, denticulate or coarsely dentate, teeth ending in a sclerotic tip, stipitate glandular trichomes on both blade surfaces, sometimes with sessile glandular trichomes in pits. Heads radiate, sessile, 2.5–3 cm diam.; involucre hemispheric, resinous, $5-12 \times 12-20$ mm; phyllaries in 5 or 6 unequal series, graduated, acuminate, 5–12 mm, erect or spreading, glabrous; acumen filiform, flat, 2–3 mm, erect or lightly spreading, with stipitate or sessile glandular trichomes. Ray florets 16 to 35; tube glabrous, ligule linear-elliptic, 8–15 mm, apex entire. Disk florets with corolla 5–6 mm, with an abruptly ampliate throat. Achenes elliptic, yellowish or dull brownish, 4-angled, 3–4.5 mm, smooth or faintly striate, apex coronate to knobby; pappus of 2 or 3 bristles, 3–4 mm, contorted to curved, smooth to barbellulate.

Etymology. The specific epithet refers to the entire margin of the leaves, from the Latin “integri-,” meaning “entire,” and “-folius,” meaning “-leaved.”

Discussion. *Grindelia integrifolia* is characterized by its sessile heads, acuminate phyllaries in graduated series, with filiform acumen, and leaves clasping or with a subcordate base, with stipitate glandular trichomes on both surfaces, the teeth ending in a sclerotic tip.

Two forms are recognized for *Grindelia integrifolia* and may be distinguished by the following couplet.

- 1a. Leaves with margin entire, occasionally serrate or denticulate, with only stipitate glandular trichomes on both surfaces
..... 16a. *G. integrifolia* f. *integrifolia*
- 1b. Leaves with margin coarsely dentate, with stipitate glandular trichomes and sessile glandular trichomes in pits on both surfaces
..... 16b. *G. integrifolia* f. *dentata*

16a. *Grindelia integrifolia* f. *integrifolia*.

Grindelia virgata Nutt., Trans. Amer. Philos. Soc. 7: 314. 1841. *Grindelia integrifolia* DC. var. *virgata* (Nutt.) Torr. & A. Gray, Fl. N. Amer. (Torr. & A. Gray) 2: 248. 1842, non *Grindelia integrifolia* DC. var. *virgata* (Nutt.) Steyerl., Ann. Missouri Bot. Gard. 21: 552–553, nom. illeg. TYPE: U.S.A. Oregon: near Fort Vancouver, s.d., *J. T. Nuttall* s.n. (holotype, PH [barcode] 00047870 digital image!; isotypes, BM [barcode] 000810697 digital image!, PH [barcode] 01085479 digital image!).

Grindelia integrifolia DC. f. *villosa* Steyerl., Ann. Missouri Bot. Gard. 21: 553. 1934, syn. nov. [described under *Grindelia integrifolia* var. *virgata*]. TYPE: U.S.A. Oregon: 1871, *E. Hall* 266 (holotype, MO [barcode] 714090!; isotypes, F [barcode] 0050289F digital image!, GH [barcode] 00037701!, MO [barcode] 714092!, NY [barcode] 169608!, US [barcode] 00008210 digital image!).

Leaves with margin entire, occasionally serrate or denticulate, with only stipitate glandular trichomes on both surfaces. Chromosome numbers: $n = 6$ (Chambers et al., 1998: 19, sub *Grindelia integrifolia* $\times$ *G. nana*); $2n = 24$ (Morton, 1981: 361).

Iconography. Steyerl. (1934: 540, fig. 31).

Distribution and habitat. *Grindelia integrifolia* f. *integrifolia* has been collected in prairies, trenches, and marshy ground, from 0 to 200 m, in Oregon and Washington (U.S.A.).

Phenology. *Grindelia integrifolia* f. *integrifolia* flowers from July to October.

Common name. Puget Sound gumweed (<<http://plants.usda.gov/>>).

Additional specimens examined. U.S.A. **Oregon:** Hood River Co., *L. F. Henderson* 432 (MO), *L. F. Henderson* 434 (MO, NY); N Yamhill, 8 July 1882, *J. T. Howell* s.n. (MO, NY); Tillamook Co., Tillamook Bay, 16 July 1882, *L. F. Henderson* s.n. (NY); Washington Co., Twisp, *A. Bradley* 477 (MO); vic. Victoria, *J. Macoun* 421 (MO). **Washington:** Mason Co., Potlatch St. Park, *A. Colwell* & *A. Denton* 85 (MO).

16b. *Grindelia integrifolia* f. *dentata* Steyerl., Ann. Missouri Bot. Gard. 21: 551. 1934. TYPE: U.S.A. Oregon: on waste ground, Salem, 14 July 1917, *J. C. Nelson* 1670 (holotype, GH [barcode] 00037700!).

Leaves with margin coarsely dentate, with stipitate glandular trichomes and sessile glandular trichomes in pits on both surfaces. Chromosome number not known.

Distribution and habitat. *Grindelia integrifolia* f. *dentata* has been collected on waste ground in Oregon (U.S.A.). It is known only from the type specimen, which is a unicate.

Phenology. *Grindelia integrifolia* f. *dentata* flowers in July.

Etymology. The name of this form is taken from the Latin “dentatus,” meaning “toothed,” which refers to the margin of leaves.

Discussion. *Grindelia integrifolia* f. *dentata* is only known from the type collection, and until further collections from the region are available, we consider it cautious to maintain the taxonomic form.

17. *Grindelia inuloides* Willd., Mag. Neuesten Entdeck. Gesamten Naturk. Ges. Naturf. Freunde Berlin 1: 261. 1807. TYPE: Mexico: cultivated in B, sub nom. *Aster spathulatus* Lindl. (non *Aster spathulatus* Lag.) (lectotype, designated here from B-W-16437 holotype† fragm. at UC, not seen, UC [barcode] 292697 image!).

Perennial subshrubs, 0.2–0.35 m, with xylopodium; stems 1 to several, not ramified or with few branches, glabrous or with stipitate or sessile glandular trichomes. Leaves herbaceous or subcoriaceous, sessile, linear-oblong to oblong, $0.5\text{--}6 \times 0.2\text{--}2$ cm, clasping or with base subcordate; blade apex acute, margin subentire or serrate, teeth ending in a sclerotic tip, simple hairs and stipitate or sessile glandular trichomes on both blade surfaces; cauline leaves acuminate, progressively smaller. Heads radiate, subsessile or pedunculate, 2.5–3 cm diam.; involucre hemispheric-campanulate, scarcely resinous, $8\text{--}12 \times 13\text{--}25$ mm; phyllaries in 5 or 6 subequal series, acuminate, linear to narrowly oblong, erect or reflexed, 3.5–10 mm, subcoriaceous, with stipitate or sessile glandular trichomes, margin entire; acumen linear-elliptic to narrowly ovate, flat to subterete, ca. 1 mm, with sessile glandular trichomes. Ray florets 25 to 50; tube glabrous, ligule elliptic, 11–16 mm, apex entire. Disk florets with corolla 5–6 mm with a gradually ampliate throat. Achenes dull brown, elliptic, slightly flattened to 3- or 4-angled, smooth or with transverse incisions, apex truncate; pappus of 2 bristles, 3–6.5 mm, smooth.

Etymology. The specific epithet is taken from the genus *Inula* L. (Asteraceae) and, according to the author, refers to its resemblance to this genus.

Discussion. Diagnostic features of *Grindelia inuloides* include the radiate heads with acuminate phyllaries in subequal series within the involucre, the linear-elliptic to narrowly ovate acumen, and the leaves with teeth that end in a sclerotic tip.

Sessé and Mociño collected seeds of *Grindelia inuloides* in Mexico, and in 1804 sent them to the Royal Botanical Garden of Madrid where they were cultivated under the name *Aster spathulatus*. Offspring of these plants were cultivated at Montpellier Botanical Garden. In 1806, Professor P. M. A. Broussonet sent seeds of this species to several botanical gardens, including the Botanic Garden at Berlin, where Willdenow studied the plants cultivated there and described them as a new genus under the name *G. inuloides*.

From 1790 to 1792, Sessé and Mociño's expedition took them from Sonora to Michoacán and then through Álamos and Tarahumara to Aguascalientes (<http://www.rjb.csic.es/jardinbotanico/jardin/index.php?len=&Pag=91>). Comparing the travel of the expedition with the area of distribution of *Grindelia inuloides*, it is probable that the seeds of this taxon were collected in the states of Jalisco or Michoacán.

The type specimen of *Grindelia inuloides* was destroyed during World War II, but its fragment (and a photograph) were conserved at UC, which we propose here as the lectotype of the species. No other isotypes were found in other herbaria.

Three varieties are recognized with *Grindelia inuloides* and may be distinguished by this brief key.

- 1a. Stems, leaves, and phyllaries with sessile glandular trichomes 17a. *G. inuloides* var. *inuloides*
- 1b. Stems, leaves, and phyllaries with stipitate glandular trichomes.
 - 2a. Cauline leaves 0.2–1.5 cm wide 17b. *G. inuloides* var. *glandulosa*
 - 2b. Cauline leaves 2 cm wide 17c. *G. inuloides* var. *latamplexa*

17a. *Grindelia inuloides* var. *inuloides*.

Demetria spathulata Lag., Gen. Sp. Pl. (Lagasca), 30. 1816.

TYPE: [Mexico.] Cultivated at Hort. Madrid., 1822, *J. D. Rodriguez s.n.* (neotype, designated here, MA [barcode] 240984 digital image!).

Grindelia angustifolia Kunth, Nov. Gen. Sp. [H. B. K.] 4: 244–245 (folio ed.). 1818. [also 4: 309–310 (quarto ed.). 1820.] *Grindelia arguta* Schrad. ex DC., Prodr. (DC.) 5: 315. 1836, nom. illeg. TYPE: Mexico. Michoacán: “prope Valladolid de Michoacán & Pazcuaro,” s.d., *F. W. Humboldt & A. J. Bonpland s.n.* (holotype, B-W-16438-010 digital image!; isotypes, P [barcode] 00742791 digital image!, P [barcode] 00742794 digital image!).

Grindelia pubescens Nutt., J. Acad. Nat. Sci. Philadelphia 7: 74. 1834. TYPE: U.S.A. Arkansas: [Mexico, cf. Steyermark (1934: 454)], *T. Nuttall s.n.* (holotype,

PH [barcode] 00047866!; isotype, GH [barcode] 00008437 digital image!).

Stems, leaves, and phyllaries with sessile glandular trichomes. Cauline leaves 0.5–5 × 0.2–2 cm, sometimes clasping. Chromosome number: $n = 6$ (Powell & Turner, 1963: 135; Semple et al., 1989: 302).

Iconography. Steyermark (1934: 457, fig. 1).

Distribution and habitat. *Grindelia inuloides* var. *inuloides* has been collected in the Federal District and in Guanajuato, Jalisco, Michoacán, Nuevo León, Queretaro, Sierra Madre Oriental, Puebla, and Veracruz (Mexico). The autonymic variety has been collected in pine and oak forests, from 1800 to 2350 m.

Phenology. *Grindelia inuloides* var. *inuloides* flowers from June to October.

Common names. Palancapatli de Puebla, gum daisy (<http://www.conabio.gob.mx/malezasdemexico/asteraceae/grindelia-inuloides/fichas/ficha.htm#1>. Nombres>).

Discussion. Steyermark (1937: 226) stated that *Inula serrata* Pers. (nom. illeg., non *I. serrata* Gilib., Fl. Lit. Inch. I. 207. 1782) was based on *Grindelia inuloides*. However, Persoon (1807: 452) cited only “*Aster*, Lagasca. Hab. in N. Hispania,” perhaps referring to a specimen sent to him by Lagasca from the Royal Botanical Garden of Madrid, sub nom. “*A. spathulata*,” which may have corresponded to the plants upon which Lagasca described *Demetria spathulata*. No such specimen was located in the Persoon herbarium at L, so the identity of *I. serrata* remains uncertain.

Lagasca described *Demetria spathulata* based on a plant cultivated in the Royal Botanical Garden of Madrid from seed sent from Mexico by Martín Sessé in 1804, under the name “*Aster spathulatus*” (non *A. spathulatus* Lindl., 1834), whose offspring, cultivated at Berlin, constituted the type of *Grindelia inuloides*. No MA specimens appear to have been collected from the Royal Botanical Garden of Madrid between the years 1805 and 1816 with the name “*A. spathulatus*.” If such specimens did exist, then the collection might have been in Lagasca's personal herbarium, which was destroyed in Seville during his escape from Spain in 1823. Nevertheless, a specimen with the name “*A. spatulatus*,” which certainly does not belong to the same plant studied by Lagasca, but probably represents a descendant offspring, was collected from the Royal Botanical Garden of Madrid in 1822 by José Demetrio Rodríguez (when Lagasca was director

of the botanical garden). Thus we propose the *J. D. Rodriguez s.n.* specimen as neotype for *D. spathulata*.

With respect to the type of *Grindelia pubescens*, we agree with Steyermark (1934) in considering an error on the specimen label, which attributed its provenance from Arkansas (U.S.A.).

Additional specimens examined. MEXICO. **Distrito Federal:** along rte. 57, 29 mi. S of toll gate, N of Mexico City, *A. M. Powell & J. Edmondson 585* (TEX); 16 km NW of Toluca along rd. to Ixtlahuaca & 1 km E on side rd., *R. W. Sanders 1067* (TEX). **Guanajuato:** Mpio. Santa Ana, Rancho La Soledad, *C. L. Díaz Luna 13168* (TEX); Acámbaro, El Moral, *J. M. Escobedo 2509* (XAL); Las Palomas, *S. Gutierrez 1* (XAL); Puerto de Santa Rosa, *R. Gutiérrez s.n.* (XAL). **Jalisco:** 1 km adelante del Crucero a Arandas, carretera Tepatitlán–Pegueros, *R. Guzmán et al. 953* (XAL); Valle de Guadalupe, Campo Charro, carr. 80, entre Pegueros y Valle de Guadalupe, *A. Rodríguez et al. 1292* (XAL); near farmland, 42 mi. E of Guadalajara, *U. T. Waterfall 15641* (TEX). **Michoacán:** Distr. Zitacuaro, Zitacuaro–Jurungo, *G. B. Hinton 11919* (TEX); Coeneo, Rancho Quenzio, *H. D. Barriga & N. López 2492* (XAL); Penjamillo, El Encinal, *E. Pérez & E. García 1632* (XAL). **Nuevo León:** Puerto Antejos, Aramberri, *G. B. Hinton 20398* (TEX). **Puebla:** along rte. 150–140, 8 mi. E of Puebla, *A. M. Powell & J. Edmondson 616* (TEX). **Querétaro:** San Joaquín, 8 km al E de San Joaquín, sobre camino a Aguacate, *R. Fernández 4834* (XAL); Cadereyta, 500 m al W de Vizarrón, *S. Zamudio 2336* (XAL); Pinal de Amoles, *S. Zamudio 2663* (XAL). **Sierra Madre Oriental:** Cieneguillas to Puerto Santa Ana, 15 mi. SW of Galeana, *C. H. Mueller & M. T. Mueller 896* (TEX). **Veracruz:** Acultzingo, pass at Puebla–Veracruz border, ca. 4.4 mi. W of Acultzingo, *B. L. Turner 15329 with F. Barrie* (TEX, XAL); Acultzingo, La Barranca del Tule, 2350 m, *P. Ventura 15435* (XAL).

17b. *Grindelia inuloides* var. *glandulosa* (Greenm.) Steyer., Ann. Missouri Bot. Gard. 21: 456. 1934. Basionym: *Grindelia glandulosa* Greenm., Proc. Amer. Acad. Arts 34: 575. 1899. TYPE: Mexico. Hidalgo: wet meadows, Sierra de Pachuca, 13 Aug. 1898, *C. G. Pringle 6962* (holotype, F [barcode] 0050295F digital image!, GH [barcode] 00008446!; isotypes, GOET [barcode] 001586 digital image!, JE [barcode] 00000621 digital image!, K [barcode] 000221372 digital image!, M [barcode] 0029680 digital image!, MEXU-30050 digital image!, MO-130326!, NY [barcode] 00169632 digital image!, P [barcode] 00742798 digital image!, PH [barcode] 00047856 digital image!, RSA [barcode] 0001222 digital image!, TEX [barcode] 00000477!, US [barcode] 00127637 digital image!). Figure 7.

Stems, leaves, and phyllaries with stipitate glandular trichomes. Cauline leaves 0.5–5 × 0.2–1.5 cm, clasping. Chromosome number not known.

Distribution and habitat. *Grindelia inuloides* var. *glandulosa* is known from Coahuila, Hidalgo, Nuevo León, Oaxaca, and Puebla (Mexico). The variety is found in open conifer forests of *Pinus*, *Abies* Mill., and *Picea*, from 2400 to 3100 m.

Phenology. *Grindelia inuloides* var. *glandulosa* has been collected in flower from the beginning of June to August.

Etymology. The epithet of the variety is taken from the Latin “glandulosum,” meaning “gland bearing,” and refers to the presence of the glandular trichomes on the stems, leaves, and phyllaries.

Additional specimens examined. MEXICO. **Coahuila:** Buenos Aires, mtns. E of Saltillo, *J. M. Kenoyer & W. E. Crum 2778* (GH). **Hidalgo:** Sierra de Pachuca, *C. G. Pringle 9913* (TEX). **Nuevo León:** Mpio. Galeana, ca. 5 mi. S of Tanquecillos on rd. betw. San Rafael jct. & Galeana, *G. L. Nesom et al. 7194* (TEX); Mpio. Zaragoza, N side of Peña Nevada at Puerto Pinos & jct. with rd. to Joya de San Diego, on rd. from San Antonio de Peña Nevada, *G. L. Nesom et al. 7105* (TEX). **Oaxaca:** fields along rte. 190, ca. 1 mi. N of Tamazulapan, *R. Merrill King 2934* (TEX); along rte. 190, 7 mi. E of Tierra Blanca, *A. M. Powell & J. Edmondson 714b* (TEX). **Puebla:** Boca del Monte, *C. A. Purpus 2466* (GH); Mpio. Caltepec, Rincón de la Hierba, la Mesa Chica at W de Caltepec, *P. Tenorio Lezama et al. 6733* (TEX).

17c. *Grindelia inuloides* var. *latamplexa* G. L. Nesom, Phytologia 68: 327. 1990. TYPE: Mexico. Querétaro: 2.7 km SW of Pinal de Amoles on Hwy. 120, 1.7 km NE of SARH forestry fire station, 27 Dec. 1980, *J. M. Canne-Hilliker & D. W. Woodland 1941* (holotype, F [barcode] 0050296F digital image!). Figure 8.

Stems, leaves, and phyllaries with stipitate glandular trichomes. Cauline leaves 3–6 × 2 cm, broadly clasping. Chromosome number not known.

Distribution and habitat. *Grindelia inuloides* var. *latamplexa* has been collected in pine and oak forests, from 2300 to 2400 m, in Querétaro (Mexico).

Phenology. *Grindelia inuloides* var. *latamplexa* was collected in flower in November and December, an unusual time of flowering for North American species of the genus.

Etymology. The name of the variety is taken from the Latin “latus,” meaning “broad” or “wide,” and “amplectens,” meaning “clasping,” which refers to the base of the leaves.

Additional specimens examined. MEXICO. **Querétaro:** 15 mi. W of Pinal de Amoles, *B. L. Turner 76-13* (TEX).

18. *Grindelia laciniata* Rydb., Fl. Rocky Mts., 848, 1066. 1917. TYPE: U.S.A. Utah: Montezuma

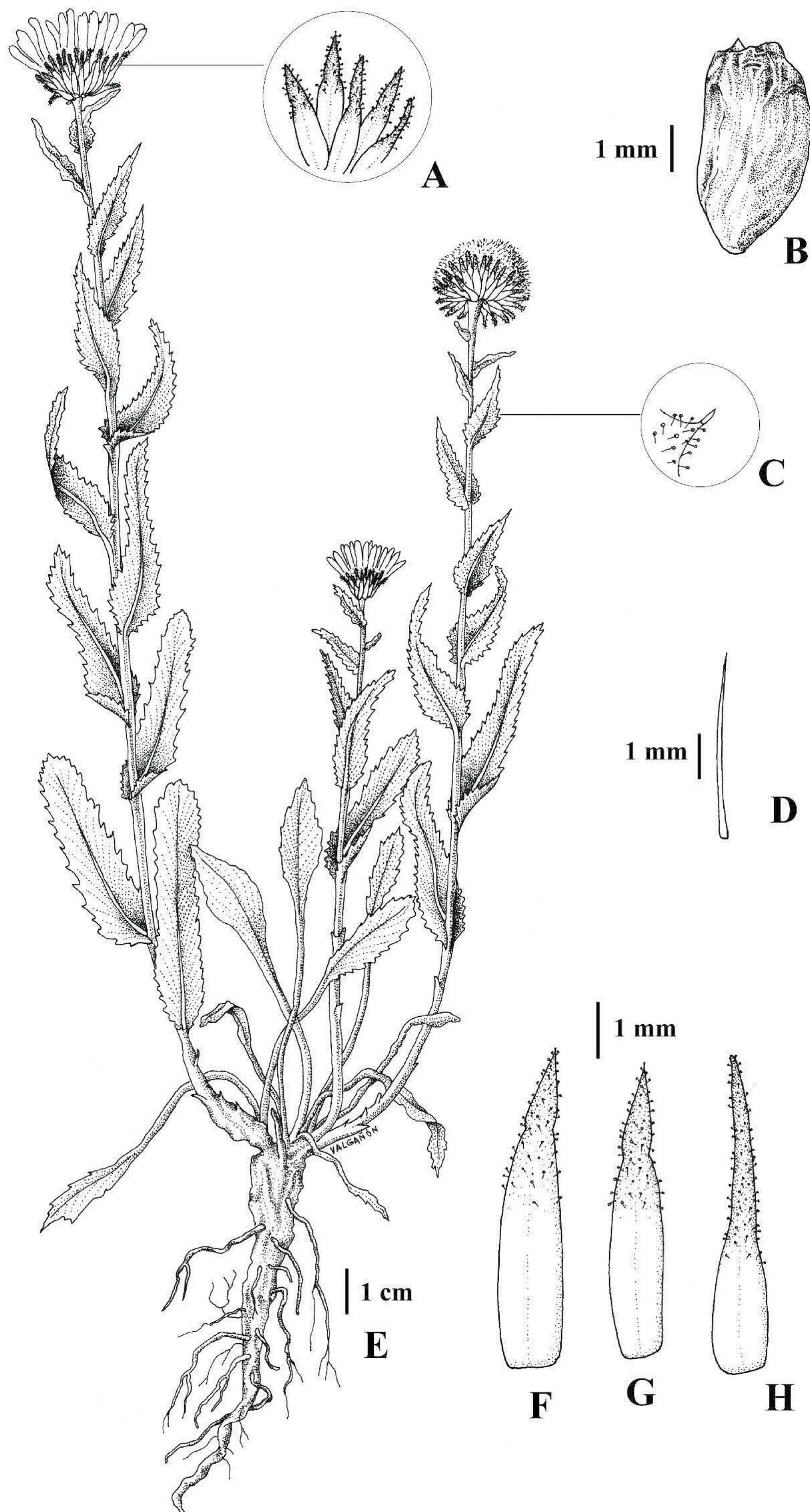


Figure 7. *Grindelia inuloides* Willd. var. *glandulosa* (Greenm.) Steyerl. —A. Part of the involucre, inner phyllary series represented. —B. Achene. —C. Leaf tooth, ending in a sclerotic tip, also covered with stipitate glandular trichomes. —D. Pappus, showing one of two smooth bristles. —E. Fertile habit. F–H. Representative phyllaries. —F. Inner series. —G. Middle series. —H. Outer series. Drawn from *R. Merrill King 2934* (TEX).

Canyon, E of Monticello, 2000 m, 13 Aug. 1911, *P. A. Rydberg 9692 with A. O. Garrett* (holotype, NY [barcode] 00169612 digital image!; isotypes, RM [barcode] 0001123 digital image!, US [barcode] 00127641 digital image!).

Perennial subshrubs, 0.25–0.3 m, with xylopodium; stems several, ramified, glabrous. Leaves herbaceous, sessile, linear to narrowly ovate; basal leaves pinnatisect, $2\text{--}4 \times 0.2\text{--}1.5$ cm: blade apex acute, margin toothed, teeth ending in a sclerotic tip, sessile glandular trichomes in pits on both blade surfaces. Heads radiate, pedunculate, 1 cm diam.; involucre hemispheric, scarcely resinous, $5\text{--}6 \times 6\text{--}7$ mm; phyllaries in 4 or 5 unequal series, graduated, subulate, subcoriaceous, linear-elliptic, 2.5–6 mm, spreading to reflexed, glabrous. Ray florets 12 to 15; tube glabrous, ligule elliptic, 7–10 mm, apex entire. Disk florets with corolla 4–5 mm, with a gradually ampliate throat. Achenes dark brown, elliptic, 4-angled, smooth, apex truncate; pappus of 2 setiform awns, 3–4 mm, barbellulate. Chromosome number: $2n = 12$ (Cronquist, 1994: 254).

Iconography. Steyermark (1934: 505, fig. 19); Cronquist (1994: 255).

Distribution and habitat. *Grindelia laciniata* grows on arid plains and canyons, at ca. 2000 m, in Utah (U.S.A.).

Phenology. *Grindelia laciniata* flowers from July to September.

Etymology. The specific epithet is taken from the Latin “laciniatus,” meaning “slashed into narrow divisions with tapered, pointed incisions,” which refers to the pinnatisect leaves.

Discussion. The differentiating characters of *Grindelia laciniata* include radiate heads with subulate phyllaries in a graduated series on the involucre, and leaves that are pinnatisect, with sessile glandular trichomes in pits. Strother and Wetter (2006) included this species in the synonymy of *G. arizonica*, but in this species the phyllaries are acuminate and the leaves are entire, with sessile glandular trichomes not in pits.

Additional specimens examined. U.S.A. **Utah:** San Juan Co., mesa E of Monticello, *P. A. Rydberg 9210* (NY); along US 163 N of Monticello, *M. A. Wetter 720* (NY); 2.9 mi. N of jet. with US 666 at Monticello, *M. A. Wetter 77* (NY), *M. A. Wetter 888* (NY).

19. *Grindelia lanceolata* Nutt., J. Acad. Nat. Sci. Philadelphia 7: 73. 1834. TYPE: U.S.A. [Arkansas or Oklahoma:] “Arkansas,” s.d., *Dr. [Z.] Pitcher s.n.* (lectotype, designated here, PH

[barcode] 01049678!; isoelectotype, NY [barcode] 169613!).

Perennial subshrubs or shrubs; stems 1 to 5, ramified, glabrous or with scattered simple hairs. Leaves herbaceous or subcoriaceous, sessile, elliptic, narrowly oblong, oblong, broadly ovate, or triangular-ovate, clasping; blade apex acute, margin finely serrate, serrate, deeply toothed, or pinnatisect, rarely entire, teeth ending in a curved spinule, simple hairs absent or present along the main nerve, on the margins, or on both blade surfaces, sessile glandular trichomes, frequently in pits, on both surfaces. Heads radiate, pedunculate; involucre campanulate, resinous, $8\text{--}13 \times 12\text{--}23$ mm; phyllaries in 5 or 6 subequal series, acuminate, linear, 8–16 mm, glabrous, with sessile glandular trichomes in pits; apex spinulose; the outer bracts erect or reflexed, acumen linear, terete, 3–4 mm, about equal to the height of the disk; the inner bracts erect, exceeding the height of the disk. Ray florets 14 to 31; tube glabrous, ligule elliptic, 10–16 mm, apex entire. Disk florets with corolla 5–6 mm, with a gradually ampliate throat. Achenes elliptic, yellowish or brownish gray, somewhat flattened, 3- or 4-angled, striate, apices coronate or knobby; pappus of 2 setiform awns, 4–7 mm, smooth to barbellate.

Etymology. The specific epithet is taken from the Latin “lanceolatus,” meaning “a shape broadest at the middle and tapering to each end,” which refers to the lanceolate shape of the leaves.

Discussion. *Grindelia lanceolata* is characterized by its radiate heads, with acuminate phyllaries arranged in subequal series within the involucre. The phyllary acumen is linear; the leaves are entire or pinnatisect, with the marginal teeth ending in a curved spinule; the sessile glandular trichomes are frequently in pits on both blade surfaces; the achene has an either coronate or knobby apex.

Nuttall’s protologue (1834: 73) for *Grindelia lanceolata* states “Hab. In Arkansas. T. Nuttall and Dr. Pitcher.” We could not find a specimen of *G. lanceolata* collected by Nuttall in Arkansas, but there are two specimens of a Pitcher collection in NY and PH. We chose the PH specimen as lectotype because it has an original label with the name *G. lanceolata*, and it is representative of this species. The NY isoelectotype also has on the same sheet a specimen (NY [barcode] 169614) collected by *T. Drummond* in Texas (n° 137).

Grindelia lanceolata is represented by four varieties that are geographically distinct. The autonymic variety has the broadest documented range, occurring in Alabama, Arkansas, Missouri, and

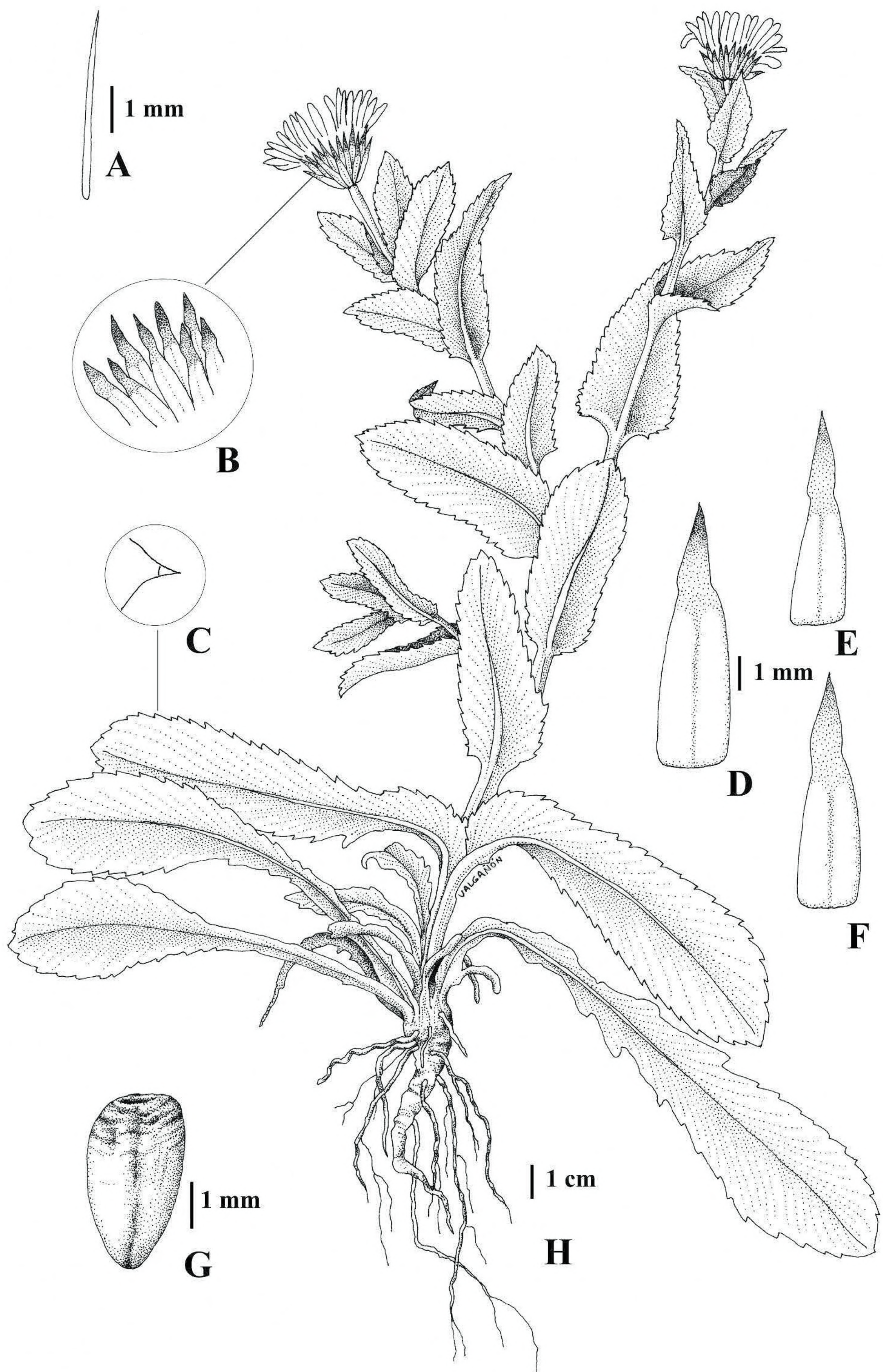


Figure 8. *Grindelia inuloides* Willd. var. *latamplexa* G. L. Nesom. —A. Pappus, showing one of two smooth bristles. —B. Part of the involucre, inner phyllary series represented. —C. Leaf tooth, ending in a sclerotic tip, also covered with stipitate glandular trichomes. D–F. Representative phyllaries. —D. Inner series. —E. Outer series. —F. Middle series. —G. Achene. —H. Fertile habit. Drawn from *B. L. Turner 76-13* (TEX).

Oklahoma. *Grindelia lanceolata* var. *greenei* (Steyerm.) G. L. Nesom has the southernmost distribution, collected from Nuevo León, Mexico; *G. lanceolata* var. *subincisa* is known from Colorado and New Mexico. *Grindelia lanceolata* var. *texana* naturally occurs in Texas and Oklahoma, extending south to Coahuila, Mexico. Four varieties are recognized within *G. lanceolata* and are distinguished by the following key couplets.

- 1a. Basal leaves deeply toothed to pinnatisect; heads less than 2.5 cm diam 19c. *G. lanceolata* var. *subincisa*
- 1b. Basal leaves toothed, serrate, or minutely serrate; heads 2.5–3.5 cm diam.
 - 2a. Leaves triangular-oblong, margins irregularly toothed 19d. *G. lanceolata* var. *texana*
 - 2b. Leaves narrowly oblong to ovate-elliptic, margins serrate.
 - 3a. Basal and middle leaves narrowly oblong, oblong, or ovate-elliptic, 3.5–11 cm, margins serrate; heads 2.5–3.5 cm diam 19a. *G. lanceolata* var. *lanceolata*
 - 3b. Basal and middle leaves broadly ovate-elliptic, 1.9–2.9 cm, margins minutely serrate; heads 2.5–2.7 cm diam 19b. *G. lanceolata* var. *greenei*

19a. *Grindelia lanceolata* var. *lanceolata*.

Grindelia littoralis Steyerm., Ann. Missouri Bot. Gard. 21: 516. 1934. TYPE: U.S.A. Texas: Galveston Bay, 20 Sep. 1884, *J. F. Joor s.n.* (holotype, MO-130019!; isotype, MO-130018 digital image!).
Grindelia lanceolata Nutt. f. *latifolia* Steyerm., Ann. Missouri Bot. Gard. 21: 515. 1934, syn. nov. TYPE: U.S.A. Missouri: Stone Co., Marble Cave, 11 Sep. 1898, *W. Trelease s.n.* (holotype, MO [barcode] 714089!).

Shrubs 0.3–1.5 m. Leaves narrowly oblong, oblong, or ovate-elliptic, 3.5–11 × 0.35–2 cm, margin serrate. Heads 2.5–3.5 cm diam. Chromosome numbers: $n = 6$ (Dunford, 1986: 303); $2n = 12$ (Whitaker & Steyermark, 1935: 71; Dunford, 1969: 20).

Iconography. Steyermark (1934: 518, fig. 22; 1972: 1479, pl. 351, fig. 5).

Distribution and habitat. *Grindelia lanceolata* var. *lanceolata* grows on rocky slopes, prairies, nude and degraded soils, from 0 to 700 m, in Alabama, Arkansas, Missouri, and Oklahoma (U.S.A).

Phenology. *Grindelia lanceolata* var. *lanceolata* has been collected in flower from the beginning of July to October.

Common names. Narrow-leaf gumweed (<<http://plants.usda.gov/>>), spiny-tooth gumweed (<[\[www.unl.edu/agnicpls/gpcn/lating/\]\(http://www.unl.edu/agnicpls/gpcn/lating/\)>; <<http://wisplants.uwsp.edu>>\).](http://</p></div><div data-bbox=)

Additional specimens examined. U.S.A. **Alabama:** Franklin Co., *R. Kral 44003* (MO). **Arkansas:** Independence Co., beside Green Creek, on way to Batesville, *R. D. Thomas 20565* (MO); Independence, Polk Bayou, E of Cushman, spoil bank area at old manganese mine, *R. D. Thomas & R. Reid 20964* (XAL). **Missouri:** Barry Co., 21 Aug. 1892, *F. M. Diwart s.n.* (MO-129990); dolomite ledges & slopes, bald knobs near Seligman, *E. J. Palmer 29364* (MO); rocky slopes, bald knobs, near Eagle Rock, *E. J. Palmer 31465* (MO); Johnson Co., field bordering upland prairie thickets, 2 mi. W of Warrensburg, *J. A. Steyermark 24602* (MO); McDonald Co., shale outcrops, hillsides, Noel, *E. J. Palmer 4161* (MO); Ozark Co., rocky open ground, bald knobs, bald Jesse near Gainesville, *E. J. Palmer 33055* (MO); St. Louis Co., *M. C. Lodewyks 80* (MO); Taney Co., Hughie Bald, near Branson, *M. A. Wetter 483* (MO); 1/2 mi. E of Table Rock Dam, *P. L. Redfearn Jr. 33149* (MO). **Oklahoma:** Creek Co., Sapulpa, *B. F. Bush 220* (MO).

19b. *Grindelia lanceolata* var. *greenei* (Steyerm.) G. L. Nesom, Phytologia 68: 324. 1990. Basionym: *Grindelia greenei* Steyerm., Ann. Missouri Bot. Gard. 21: 517. 1934. TYPE: Mexico. Nuevo León: vic. Monterrey, 1924, *C. R. Orcutt 1204* (holotype, US [barcode] 00127638 digital image!).

Shrubs 1.2 m. Leaves broadly ovate-elliptic, 1.9–2.9 × 1–1.5 cm, margins with small regular teeth. Heads 2.5–2.7 mm diam. Chromosome number not known.

Iconography. Steyermark (1934: 518, fig. 23).

Distribution and habitat. *Grindelia lanceolata* var. *greenei* has been collected in Nuevo León (Mexico).

Phenology. *Grindelia lanceolata* var. *greenei* flowers at the beginning of October.

Etymology. *Grindelia lanceolata* var. *greenei* was named in honor of Edward Lee Greene (1843–1915), first professor of botany at the University of California, Berkeley. He collected in the western United States, from states such as Colorado, New Mexico, and California.

Additional specimen examined. MEXICO. **Nuevo León:** Mpio. Monterrey, 9 Oct. 1937, *L. A. Kenoyer s.n.* (MO-1136023).

19c. *Grindelia lanceolata* var. *subincisa* (Greene) Adr. Bartoli & Tortosa, comb. nov. Basionym: *Grindelia subincisa* Greene, Pittonia 4: 154–155. 1900. *Grindelia decumbens* Greene var. *subincisa* (Greene) Steyerm., Ann. Missouri Bot. Gard. 21: 503–504. 1934. TYPE: U.S.A. New Mexico: Chama, 5 Sep. 1899, *C. F. Baker 683*

(lectotype, designated here, NDG-47371 digital image!; isoelectotypes, F [barcode] 0050293F digital image!, GH [barcode] 00008442!, MO-130298!, NDG-53651 digital image!, NDG-53652 digital image!, NY [barcode] 169630!, RM [barcode] 0001131 digital image!, RSA [barcode] 0001220 digital image!, US [barcode] 00127660 digital image!, US [barcode] 00369208 digital image!). Figure 9.

Subshrubs 0.24–0.40 m. Leaves elliptic, $2\text{--}6 \times 0.3\text{--}0.75$ cm, margins deeply toothed to pinnatisect. Heads less than 2.5 cm diam. Chromosome number not known.

Distribution and habitat. *Grindelia lanceolata* var. *subincisa* has been collected along streams and lowlands, from 2000 to 2300 m, in Colorado and New Mexico (U.S.A.).

Phenology. *Grindelia lanceolata* var. *subincisa* has been collected in flower from July to September.

Etymology. The name of this variety is taken from the Latin “*incisus*,” meaning “cut deeply and sharply,” which refers to the degree of division of the leaf blade.

Discussion. For *Grindelia subincisa*, Greene’s protologue does not state a collection, but Wooton and Standley (1915: 655) indicated the collection *C. F. Baker 683* as the type, and this opinion is followed here. In the Greene Herbarium at NDG, there are three specimens of *G. subincisa* collected by Baker on 5 September 1899 at Chama, probably all representing the same collection, and all three sheets correspond to the protologue. We chose the NDG sheet with barcode number 47371 as lectotype, because it is the only sheet that includes the collector number 683 on the label.

This taxonomic entity was later considered a variety of *Grindelia decumbens* by Steyermark (1934), but the species differs from *G. lanceolata* by its phyllaries with a triangular, subterete acumen, and the phyllaries arranged in a graduated series in the involucre. The leaves in *G. decumbens* have marginal teeth that end in a sclerotic tip. In *G. lanceolata*, the phyllaries have a spinulose tip arranged in five or six subequal series.

Additional specimens examined. U.S.A. **Colorado:** Conejos Co., 13.3 mi. NE of Conejos–Archuleta Co. line, *M. A. Wetter 956* (NY); La Plata Co., 9.6 mi. E of La Plata–Montezuma Co. line, *M. A. Wetter 964* (NY); Mineral Co., 28.3 mi. NW of Mineral–Río Grande Co. line, *M. A. Wetter 961* (NY). **New Mexico:** Río Arriba Co., along cumbers, Toltec Scenic Railway at Sublette NM Station, *M. A. Wetter 1031* (NY).

19d. *Grindelia lanceolata* var. *texana* (Scheele) Shinnars, Field & Lab. 19: 78. 1951. *Grindelia texana* Scheele, Linnaea 21: 601. 1848. TYPE: U.S.A. Texas: 1846, *F. Lindheimer 418* (lectotype, designated here, US [barcode] 00127662 digital image!; isoelectotypes, G [barcode] 00301851 digital image!, GH [barcode] 00283064 [p.p. with C. Wright, 1845] digital image!, GH [barcode] 00283066 not seen, GH [barcode] 00283067 not seen, PH [barcode] 01049683 digital image!).

Shrubs 0.45–0.9 m. Leaves triangular-oblong, $2\text{--}5 \times 0.7\text{--}1.5$ cm, margins irregularly toothed. Heads 2.5–3.5 cm diam. Chromosome numbers: $n = 6$ (Dunford, 1986: 20, sub *Grindelia texana*); $2n = 12$ (Dunford, 1969: 20, sub *G. texana*).

Iconography. Steyermark (1934: 518, fig. 21), sub nom. *Grindelia texana*.

Distribution and habitat. *Grindelia lanceolata* var. *texana* has been collected from prairies, valleys with *Juglans* L., and low hills, from 850 to 1000 m, in Oklahoma and Texas (U.S.A.) and Coahuila (Mexico).

Phenology. *Grindelia lanceolata* var. *texana* has been collected in flower from the beginning of June to September.

Etymology. The specific epithet refers to the state of Texas in the United States, from which the type specimen was collected.

Discussion. The holotype of *Grindelia texana* was not found at TEX, and the Scheele Herbarium has apparently been destroyed, or is at least missing at TEX (Tom Wendt, curator, personal communication). There are specimens of this species collected by F. Lindheimer in Texas during 1846 at G, GH, PH, and US, which predate the protologue. We chose as lectotype the US specimen as representative of this taxon.

We recognize *Grindelia texana* as a variety of *G. lanceolata* because they share similar heads, leaves with sessile glandular trichomes in pits, and differ from the typical variety only by the triangular-oblong shape of the leaves, which are irregularly toothed in the margin.

Additional specimens examined. MEXICO. **Coahuila:** W slopes of Sierra del Carmen, 8 km E of Hacienda Encantada, *R. M. Stewart 1702* (GH); 21 km S by winding rd. from Rancho Chupadero del Caballo toward Las Norias, *F. Chiang, T. Wendt & M. C. Johnston 9170* (NY). U.S.A. **Oklahoma:** Garvin Co., limestone hills, Arbuckle Mtns. near Turner Falls State Park, *E. J. Palmer 42014* (MO); Murray Co., Arbuckle Mtns., *D. Demare 13192* (PH); at Turner Falls Park scenic overlook, *M. A. Wetter 1008* (NY). **Texas:** Blanco Co., Blanco, dry hillsides, *E. J. Palmer*

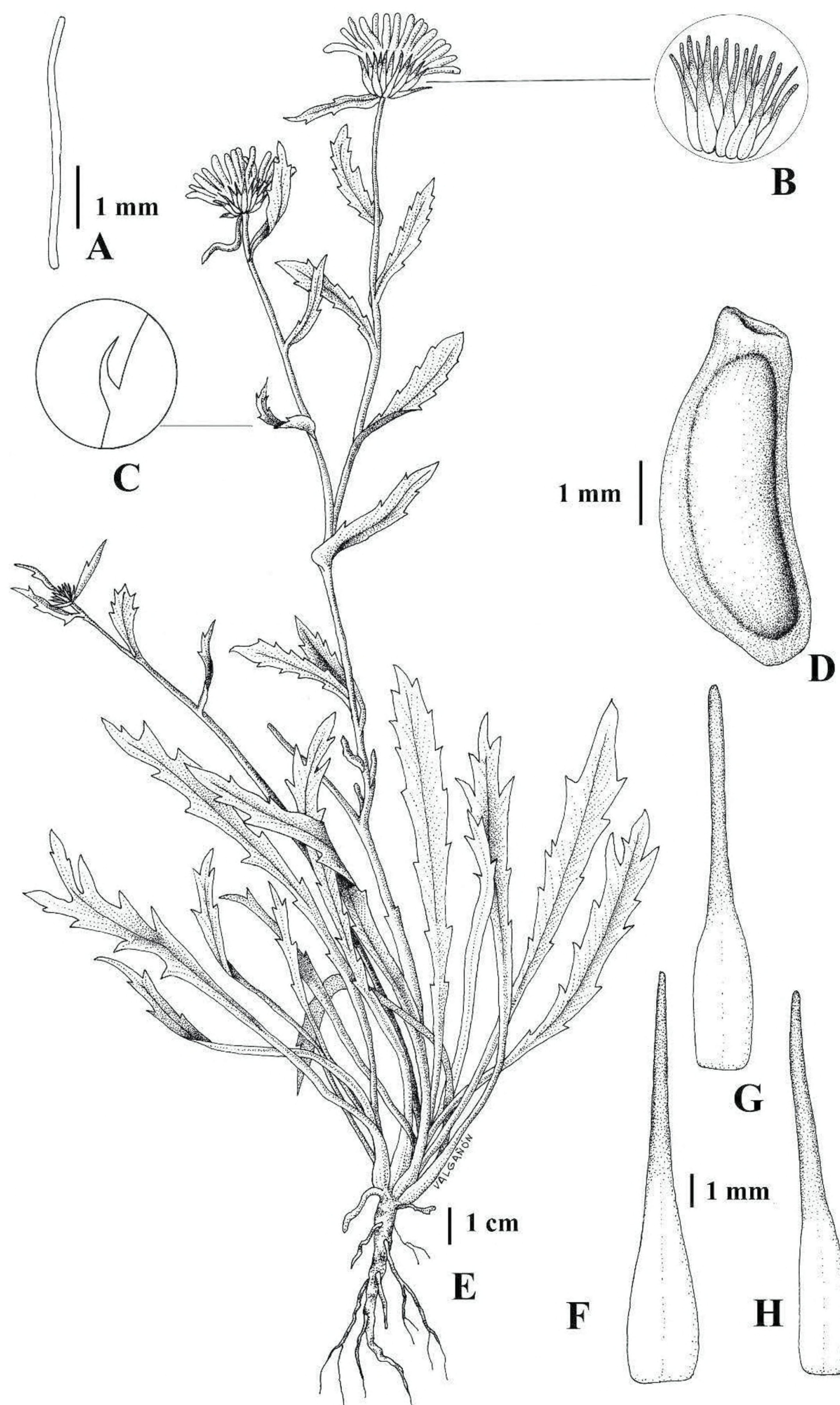


Figure 9. *Grindelia lanceolata* Nutt. var. *subincisa* (Greene) Adr. Bartoli & Tortosa. —A. Pappus, showing one of two setiform awns. —B. Involucre, with phyllaries in five or six series. —C. Leaf tooth, ending in a curved spinule. —D. Achene, somewhat flattened, 3- or 4-angled. —E. Fertile habit. F–H. Representative phyllaries. —F. Outer series. —G. Middle series. —H. Inner series. Drawn from *M. A. Wetter 1031* (NY).

12855 (MO); Burnet Co., Burnet, dry calcareous open ground, *E. J. Palmer 10249* (MO); Collin Co., Coit Meadow on Renner Rd., *C. L. Lundell 18644* (PH); Dallas Co., Dallas, *M. R. Stephenson 126* (MO); Erath Co., 1.3 mi. S of Erath–Palo Pinto Co. line, *M. A. Wetter 1010* (NY); Hopkins Co., 1 mi. E of Mount Vernon, 25 June 1949, *C. I. Stittler s.n.* (PH-837382); Kendall Co., Boerne, *F. W. Pennell 5478* (NY).

20. *Grindelia leptocarpa* (De Jong & Beaman) Adr. Bartoli & Tortosa, comb. nov. Basionym: *Olivaea*

leptocarpa De Jong & Beaman, Brittonia 15: 91–92. 1963. TYPE: Mexico. Durango: in wet valley, in pond along hwy. 45, 43.4 mi. N of Ciudad Durango, 7 Aug. 1961, *D. C. D. De Jong & E. K. Longpre 971* (holotype, MSC [barcode] 0092488 digital image!; isotypes, GH [barcode] 00010747!, US [barcode] 00124576!).

Aquatic rhizomatous herbs, 0.8 m; stems 1 or 2, scarcely ramified, glabrous, fistulose. Leaves herba-

ceous, sessile, linear to linear-oblong or fiddle-shaped, clasping; blade apex obtuse, with stipitate glandular trichomes when young, margin entire or serrate, teeth ending in a sclerotic tip; basal leaves $2.8\text{--}4.1 \times 0.25\text{--}0.5$ cm; cauline leaves $0.8\text{--}2.3 \times 0.1\text{--}0.25$ cm. Heads radiate, pedunculate, 2–3 cm diam.; involucre hemispheric, scarcely resinous, 4–7 $\times$ 10–15 mm; phyllaries in 3 or 4 subequal series, chartaceous, triangular to narrowly triangular, 3–5 mm, subulate, erect, apex herbaceous, with stipitate glandular trichomes. Ray florets 35 to 50; tube with stipitate glandular trichomes, ligule linear-elliptic, 6.5–9.5 mm, apex 3-toothed. Disk florets with corolla 3–3.8 mm, with a gradually ampliate throat, tube with stipitate glandular trichomes. Achenes elliptic, brownish green, 2-angled, flattened, 3–3.6 mm, smooth, apex truncate; pappus of 2 to 5 bristles, 3–3.8 mm, barbellulate. Chromosome number: $n = 6$ (De Jong & Beaman, 1963: 91, sub nom. *Olivaea leptocarpa*).

Iconography. De Jong and Beaman (1963: 89, figs. 10–18).

Distribution and habitat. *Grindelia leptocarpa* has been collected from alkaline lowlands, at ca. 1780 m, in Durango (Mexico).

Phenology. *Grindelia leptocarpa* flowers from August to October.

Etymology. The specific epithet is taken from the Latin “lepto-,” meaning “slender, thin, or narrow,” and from “-carpus,” meaning “fruit,” which refers to the flattened achenes.

Discussion. *Grindelia leptocarpa* and *G. tricuspis* are distinct from other species of the genus in their aquatic habit and fistulose stems. For this reason they were both described under the genus *Olivaea*, as a genus distinct from *Grindelia*. Different authors do not agree with the recognition of both genera (McVaugh, 1984; Nesom, 1997), but others have considered them as different (De Jong & Beaman, 1963; Lane & Hartman, 1996; Nesom, 2000; Nesom & Robinson, 2007). We consider it cautious to include this species in the genus *Grindelia* until more evidence is available, since the characters of the heads (radiate, with acuminate or subulate phyllaries), the pappus (composed of caducous bristles), and the achenes (glabrous, not costate) fit those of the genus *Grindelia*.

Additional specimen examined. MEXICO. **Durango:** along Hwy. 45 N of Durango, *R. D. Worthington* 8963 (NY).

21. *Grindelia macvaughii* G. L. Nesom, *Phytologia* 68: 312. 1990. TYPE: Mexico. Jalisco: 15.9 km

E of Agua El Obispo (W of Lagos de Moreno) on Hwy. 80, ditch on NW side of rd., 1770 m, 20 Aug. 1979, *M. A. Lane* 2594 (holotype, TEX [barcode] 00373593!). Figure 10.

Annual or biannual subshrubs, 0.3–0.9 m; stems several, prostrate with tips rising upward, ramified, glabrous, with sessile glandular trichomes. Leaves sessile, subcoriaceous, narrowly oblong, oblong-elliptic, or narrowly elliptic, $2\text{--}3.5 \times 0.4\text{--}0.7$ cm, clasping; blade apex acute or obtuse, margin scabrous, finely serrate, teeth ending in a sclerotic tip, sometimes spinescent, sessile glandular trichomes scattered on both blade surfaces. Heads radiate, subsessile, 1.2–1.7 cm diam.; involucre hemispheric-campanulate, resinous, $5\text{--}7 \times 9\text{--}10$ mm; phyllaries in 3 or 4 unequal series, abruptly graduated, acuminate, narrowly ovate; acumen flat to subterete, 1–3 mm, with sessile glandular trichomes in pits; the outer bracts 2–5 mm, spreading or reflexed; the upper phyllaries 7–9 mm, erect. Ray florets 15 to 25; tube glabrous, ligule narrowly elliptic, 12–18 mm, apex entire. Disk florets with corolla 5–6 mm, with a gradually ampliate throat. Achenes brown, subquadrate, 2.5–3.5 mm, with prominent transverse incisions and broad, shallow longitudinal furrows; pappus of 2 setiform awns, 5–6 mm, straight, smooth. Chromosome number not known.

Distribution and habitat. *Grindelia macvaughii* has been collected in the surroundings of Lagos de Moreno and found on desert lands, prairies, and pastures, from 1800 to 1900 m, in Jalisco (Mexico).

Phenology. *Grindelia macvaughii* has been collected in flower from August to October.

Etymology. *Grindelia macvaughii* was named in honor of Rogers McVaugh (1909–2009), research professor of botany at the UNC Herbarium, curator of Mexican plants, and professor emeritus of botany at the University of Michigan.

Discussion. Useful characters for distinguishing *Grindelia macvaughii* are its radiate, subsessile heads and hemispheric-campanulate involucre. The phyllaries are arranged in abruptly graduate series in the involucre, the phyllary acumen is flat or subterete, and the outer phyllaries are spreading or reflexed. The marginal teeth of leaves end in a sclerotic tip and are sometimes spinescent.

Grindelia macvaughii is close to *G. oxylepis*, sharing an annual or biannual habit, radiate heads with the phyllaries of the involucre arranged in abruptly graduated series, and pappus of two or three setiform awns. *Grindelia macvaughii* differs by the

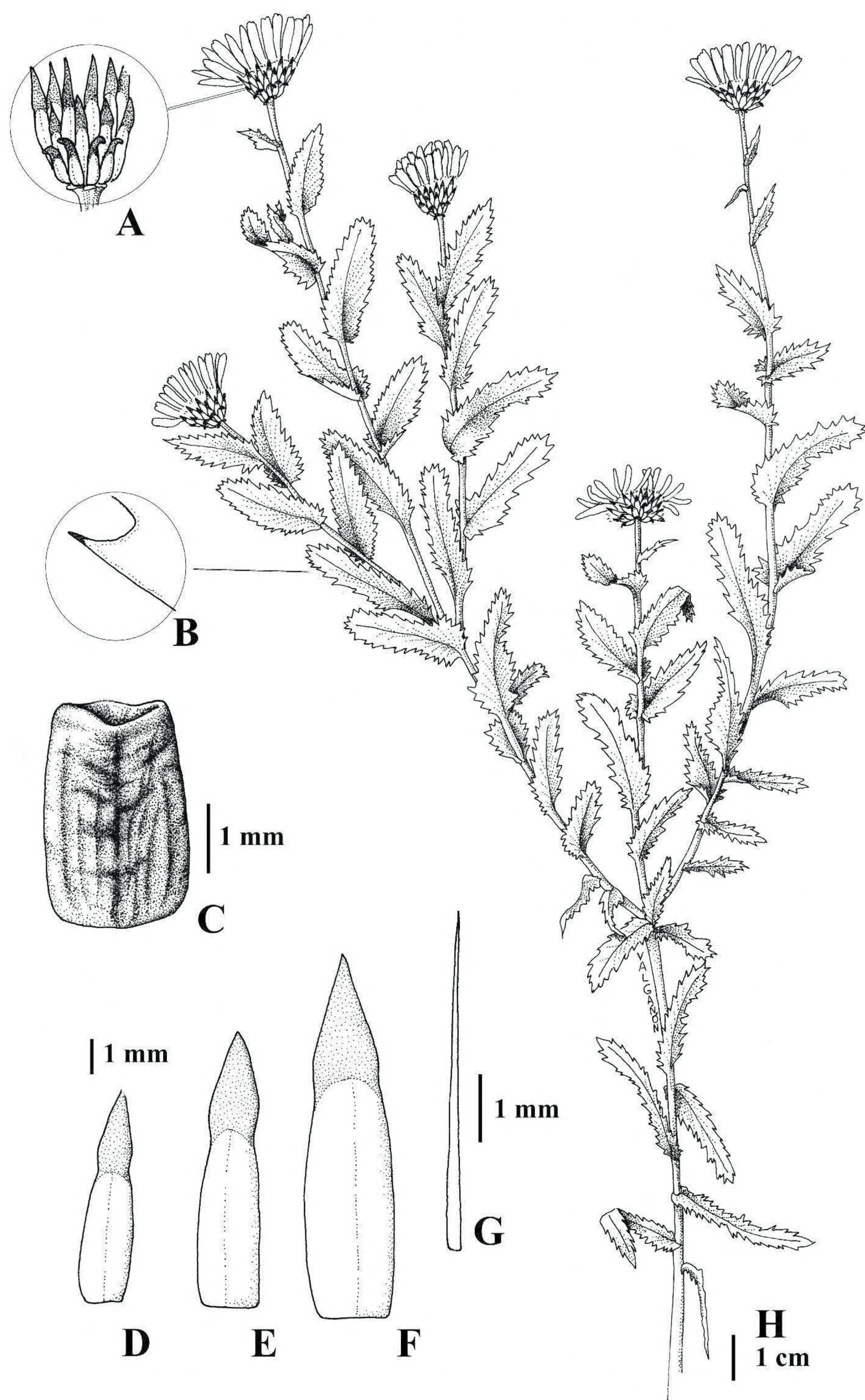


Figure 10. *Grindelia macvaughii* G. L. Nesom. —A. Involucre, with phyllaries in three or four series. —B. Leaf tooth ending in a sclerotic tip, sometimes spinescent. —C. Achene, subquadrate, with prominent transverse incisions and longitudinal furrows. D–F. Representative phyllaries. —D. Outer series. —E. Middle series. —F. Inner series. —G. Pappus, showing one of two setiform awns. —H. Fertile habit. Drawn from *R. McVaugh 12820* (TEX).

nonpunctate leaves with marginal teeth that end in a sclerotic tip (vs. punctate leaves with marginal teeth that end in a group of sessile glandular trichomes) and the acuminate (vs. subulate) phyllaries.

Additional specimens examined. MEXICO. **Jalisco:** ca. 11 mi. SE of Lagos de Moreno, near hwy. to León, *R. McVaugh* 12820 (TEX); grassland with desert shrubs, 11 mi. SE of Lagos de Moreno, *U. T. Waterfall* 13869 with *C. S. Wallis* (TEX).

22. *Grindelia microcephala* DC., Prodr. (DC.) 5: 315. 1836. *Grindelia inuloides* Willd. var. *microcephala* (DC.) A. Gray in Torr., Rep. U.S. Mex. Bound., Bot. [Emory] 2(1): 81. [July–Dec.] 1858. [1859]. TYPE: U.S.A. Texas: 1832, *J. L. Berlandier* 2057 (holotype, G-DC, IDC microfiche!; isotypes, GH [barcode] 00008431!, NY [barcode] 00169615!, P [barcode] 00742802 [“in campis, July 1829”?] digital image!). Figure 11.

Annual subshrubs, 0.25–0.4 m; stem 1, erect, ramified, with simple hairs, villous or lanuginous. Leaves subcoriaceous, sessile, oblong or spatulate, 1–3 × 0.7–2 cm, clasping; blade apex acute to obtuse, margin denticulate-crenate, teeth ending in a group of sessile glandular trichomes, simple hairs and sessile glandular trichomes in pits on both surfaces. Heads radiate, shortly pedunculate, 0.8–1.2 cm diam.; involucre hemispheric, scarcely resinous, 6–9 × 8–13 mm; phyllaries in 5 or 6 subequal series, subulate, narrowly ovate, 6–9 mm, erect or spreading, glabrous, apex flat to subterete, erect or somewhat curved, with sessile glandular trichomes. Ray florets 16 to 27; tube glabrous, ligule elliptic, 6–10 mm, apex entire. Disk florets with corolla 4–5 mm, with a gradually ampliate throat. Achenes brown, globose, 3- or 4-angled, smooth or slightly rugose, apex truncate or with a small crown; pappus of 2 or 3 setiform awns, 4–6 mm, straight or weakly contorted, smooth. Chromosome number: $2n = 12$ (Dunford, 1969: 20).

Distribution and habitat. *Grindelia microcephala* grows on rich and humid soils, from 0 to 500 m, in Texas (U.S.A.).

Phenology. *Grindelia microcephala* flowers from June to August.

Etymology. The specific epithet is taken from the Latin “micro-,” meaning “little, small,” and “-cephalus” or “headed,” which refers to the size of the heads.

Common name. Little head gumweed (<<http://www.nic.funet.fi/pub/sci/bio/life/plants>>).

Discussion. *Grindelia microcephala* is related to *G. adenodonta* and *G. pusilla*. The three species are annual subshrubs with radiate heads smaller than 1.5 cm diameter, with subulate phyllaries arranged in subequal series within the involucre. *Grindelia microcephala* and *G. pusilla* have achenes with two or three setiform awns, in contrast to the achenes of *G. adenodonta*, which are topped by two subulate scales. The achenes are slightly rugose in *G. microcephala* and sharply cut with transverse furrows in *G. pusilla*.

Additional specimens examined. U.S.A. **Texas:** Pleasanton Rd., 6 mi. S of San Antonio, 8 Aug. 1931, *M. C. Metz* s.n. (NY); Comal Co., New Braunfels, 7 Aug. 1938, *E. Ammerman* s.n. (MO-1102038); Dimmit Co., Carrizo Springs, 26 Apr. 193?, *E. Marcus* & *A. M. Jones* s.n. (MO-1012870); Uvalde Co., 1/2 mi. W of Uvalde, *J. A. Moore* & *J. A. Steyermark* 3004 (MO).

23. *Grindelia nana* Nutt., Trans. Amer. Philos. Soc. 7: 314. 1841. TYPE: U.S.A. Oregon: Vancouver, *T. Nuttall* s.n. (lectotype, designated here, BM [barcode] 001025302 digital image!; islectotype, GH [barcode] 00037702!).

Perennial subshrubs, 0.25–0.4(–0.8) m; stems several, somewhat decumbent at the base, single or ramified, glabrous. Leaves herbaceous, sessile; blade apex acute, mucronate, margin entire or toothed, teeth ending in a sclerotic tip, with sessile glandular trichomes in pits on both surfaces, sometimes with simple hairs on the margin; basal leaves narrowly obovate to narrowly elliptic, 3–9 × 0.4–1 cm, attenuate into a pseudopetiole; cauline leaves linear to narrowly elliptic, 0.7–4 × 0.3–0.5 cm. Heads radiate or discoid, pedunculate; involucre hemispheric-campanulate, resinous, 7–10 × 7–10 mm; phyllaries in 5 to 7 unequal series, graduated, acuminate, narrowly ovate, 3.5–10 mm, reflexed, glabrous; acumen terete, 1–1.5 mm, abruptly revolute, with sessile glandular trichomes. Ray florets present or absent. Disk florets with corolla 4–5 mm, with an abruptly ampliate throat. Achenes narrowly elliptic, dull brown, 4-angled, 3–4 mm, smooth, with knobs or a crown at the apex; pappus of 2 setiform awns, 3–5.5 mm, curved, smooth to barbellulate.

Etymology. The specific epithet refers to the small size of the plants and is derived from the Latin “nanus,” meaning “dwarf.”

Discussion. *Grindelia nana* is recognized by its small heads with the acuminate and reflexed phyllaries in five to seven graduated series, with the abruptly revolute acumen. Its leaves have sessile glandular trichomes in pits on both surfaces, and the blade margin presents teeth that end in a sclerotic

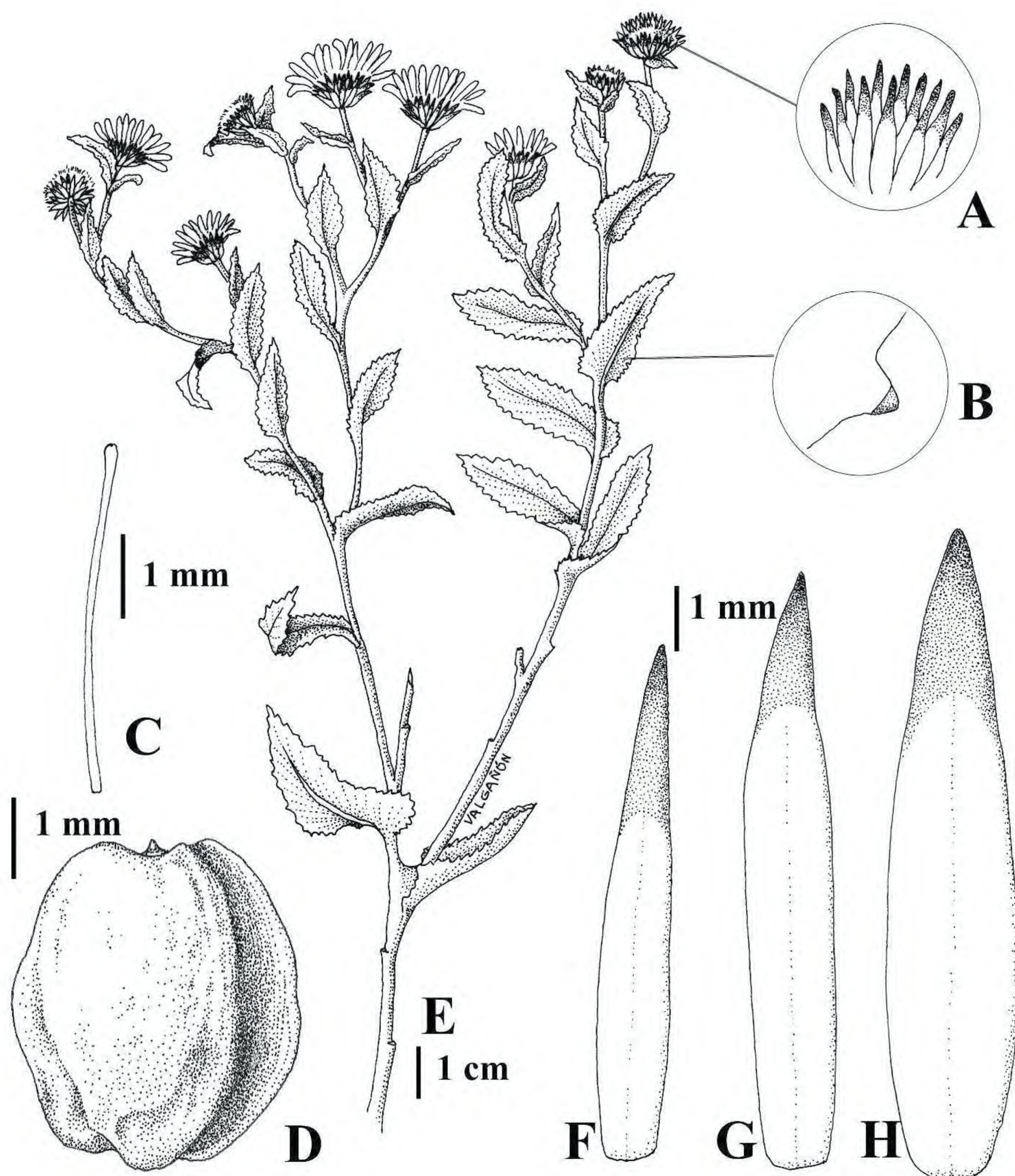


Figure 11. *Grindelia microcephala* DC. —A. Part of the involucre, inner phyllary series represented. —B. Leaf tooth, ending in a group of sessile glandular trichomes. —C. Pappus, showing one of two or three setiform awns. —D. Achene, showing the smooth or slightly rugose surface, 3- or 4-angled. —E. Fertile habit. F–H. Representative phyllaries. —F. Outer series. —G. Middle series. —H. Inner series. Drawn from J. A. Moore & J. A. Steyermark 3004 (MO).

tip. The taxon is related to *G. fastigiata*, sharing the arrangement and form of the phyllaries, the presence of pits in the leaves, and the ending of marginal teeth of the blades. *Grindelia nana* differs by the pedunculate smaller heads only 7–10 mm (vs. the larger sessile or subsessile heads in *G. fastigiata*, 10–14 × 9–17 mm). Achenes are 4-angled in *G. nana*, but are 2-angled in *G. fastigiata*.

Strother and Wetter (2006) included *Grindelia nana* in the synonymy of *G. hirsutula*, but both species are quite distinct. In *G. hirsutula*, the phyllaries are subulate (vs. acuminate in *G. nana*), the corolla of disk florets has a gradually ampliate

throat (vs. abruptly ampliate in *G. nana*), and the pappus is comprised of two to four subulate scales (vs. two setiform awns in *G. nana*).

We identified two candidate type collections by Nuttall from Vancouver. One sheet (*Nuttall s.n.*) was found at BM and matches the protologue of *Grindelia nana* (with leaves serrate). The *Nuttall s.n.* collection seen at GH was more variable, with three stems with the leaves entire and one stem with serrate leaves. We designated a lectotype for *G. nana* from the more representative specimen at BM. The sheet at GH (00037702) with the serrate-leaved stem is regarded as a duplicate and isotype for *G. nana* var. *nana*.

The Nuttall specimen at GH (*Nuttall s.n.*, GH-00037703) with stems bearing leaves with entire margins is designated as the lectotype of *G. nana* var. *integrifolia* Nutt.

Two varieties are recognized for *Grindelia nana*, as distinguished by the following couplet:

- 1a. Heads radiate 23a. *G. nana* var. *nana*
1b. Heads discoid 23b. *G. nana* var. *columbiana*

23a. *Grindelia nana* var. *nana*.

Grindelia nana Nutt. var. *integrifolia* Nutt., Trans. Amer. Philos. Soc. 7: 314. 1840. *Grindelia squarrosa* (Pursh) Dunal var. *integrifolia* (Nutt.) B. Boivin, Phytologia 23(1): 14. 1972. TYPE: U.S.A. Oregon: Vancouver, *T. Nuttall s.n.* (lectotype, designated here, GH [barcode] 00037703!).

Grindelia brownii A. Heller, Bull. Torrey Bot. Club 26: 315. 1899, syn. nov. *Grindelia nana* Nutt. f. *brownii* Steyerl., Ann. Missouri Bot. Gard. 21: 542. 1934. TYPE: U.S.A. Idaho: Nez Perces Co., 3500 ft., 14 July 1896, A. A. Heller & E. G. Heller 3418 (holotype, NY [barcode] 00169598!; isotypes, MO [barcode] 714455 digital image!, NY [barcode] 169599!, UC [barcode] 87893 digital image!, US [barcode] 00432664 digital image!).

Grindelia integerrima Rydb., Bull. Torrey Bot. Club 37: 128. 1910, syn. nov. *Grindelia nana* Nutt. var. *integerrima* (Rydb.) Steyerl., Ann. Missouri Bot. Gard. 21: 546. 1934. TYPE: U.S.A. Idaho: Kootenai Co., sandy soil near Granite Station, 29 July 1892, J. H. Sandberg, D. T. McDougal & A. A. Heller 784 (holotype, NY [barcode] 00169605!; isotypes, BM [barcode] 001025304 digital image!, CAS [barcode] 00123712 digital image!, F [barcode] 0050287F digital image!, MO [barcode] 714086 digital image!, NY [barcode] 169605!, PH [barcode] 47859!, US [barcode] 00008209 digital image!).

Grindelia nana Nutt. var. *altissima* Steyerl., Ann. Missouri Bot. Gard. 21: 544. 1934, syn. nov. TYPE: U.S.A. California: Humboldt Co., Eel River, at mouth of Larabee Creek, 200 ft., 12 Sep. 1915, J. P. Tracy 4669 (holotype, UC [barcode] 186459 digital image!; isotypes, US [barcode] 01200337 digital image!, WTU [barcode] 206930 digital image!).

Grindelia nana Nutt. f. *puberula* Steyerl., Ann. Missouri Bot. Gard. 21: 545. 1934, syn. nov. [described under *Grindelia nana* var. *altissima*]. TYPE: U.S.A. California: Lake Co., Kenseyville, 12 June 1924, J. W. Blankinship s.n. (holotype, CAS [barcode] 00123667 digital image!).

Grindelia nana Nutt. f. *longisquama* Steyerl., Ann. Missouri Bot. Gard. 21: 543. 1934, syn. nov. TYPE: U.S.A. Idaho: Nez Perce Co., Clearwater, s.d., R. Spalding s.n. (holotype, GH [barcode] 00037704!, isotypes, GH [barcode] 00037713 digital image!, GH [barcode] 00037714 digital image!, NY [barcode] 00169618!).

Grindelia nana Nutt. var. *turbinella* Steyerl., Ann. Missouri Bot. Gard. 21: 545. 1934, syn. nov. TYPE: U.S.A. California: Siskiyou Co., Shasta Valley, 10 mi. S of Gazelle in gravelly soil at base of hill, ca. 3000 ft., 7 Sep. 1917, A. A. Heller 12979 [12579 in protologue] (holotype, GH [barcode] 00037705!; isotypes, CAS

[barcode] 00123669 digital image!, F [barcode] 0050290F digital image!, MO-824996 digital image!, NY [barcode] 00169619!, PH [barcode] 00047862!, UC [barcode] 202446 digital image!, US [barcode] 00889366 digital image!, WTU [barcode] 80620 digital image!).

Heads radiate, 2–2.5 cm diam. Ray florets 11 to 28; tube glabrous, ligule linear-elliptic, 5–9 mm, apex entire. Chromosome numbers: $n = 6$ (Dunford, 1986: 303); $2n = 12$ (Whitaker & Steyermark, 1935: 71; Morton, 1981: 361; Cronquist, 1994: 256).

Iconography. Steyermark (1934: 523, fig. 27); Lane (1993: 279).

Distribution and habitat. *Grindelia nana* var. *nana* grows in rocky, sandy, and volcanic soils, on hillsides, from 700 to 750 m, in California, Idaho, Oregon, and Washington (U.S.A.).

Phenology. *Grindelia nana* var. *nana* flowers from June to August.

Common name. Idaho gumweed (<<http://plants.usda.gov/>>).

Discussion. The characters of *Grindelia brownii* (Heller, 1899: 315) match those of *G. nana* var. *nana*. *Grindelia integerrima*, from Idaho to the east of the coastal distribution of *G. nana*, was differentiated from *G. nana* by its broader phyllaries with shorter tips (Rydb., 1910: 128), but this fits within the variation observed in *G. nana* var. *nana*.

The names we include in the synonymy of *Grindelia nana* var. *nana* were all considered varieties or forms of *G. nana* by Steyermark in 1934, based on variation among stems, leaves, and the curvature of phyllaries. Nonetheless, we consider that these diverse infraspecies all fall within the variability encompassed by the autonymic variety for *G. nana*.

Taxonomically, Lane (1993) considered *Grindelia nana* var. *altissima* to be a hybrid between *G. nana* var. *nana* and *G. hirsutula* var. *davyi* (= *G. humilis* var. *humilis* in the present paper).

Additional specimens examined. U.S.A. **California:** Plumas Co., Sierra City, *M. S. Taylor* 4256 (MO); Siskiyou Co., Shasta, *H. E. Brown* 599 (PH), *E. L. Greene* 974 (MO). **Idaho:** Kootenai Co., Blackwell's Hill, Coeur d'Alene, *J. H. Christ* 11478 (NY). **Oregon:** Wasco Co., 8 mi. W of Wapinita, *J. W. Thompson* 4945 (PH); 15 mi. S of Maupin, *J. A. Moore* & *J. A. Steyermark* 3688 (MO); 15 mi. N of Maupin, 10 Aug. 1931, *J. A. Moore* & *J. A. Steyermark s.n.* (MO-1025977); 8 mi. W of Wapinita, *J. W. Thompson* 4745 (MO). **Washington:** Adams Co., in moist sagebrush slopes near Washtucna, *J. W. Thompson* 17376 (PH); Spokane Co., 28 June 1884, *W. N. Suksdorf s.n.* (PH); sandy open ground near Spokane, *E. J. Palmer* 37831 (MO); Spokane, Aug. 1898, *T. E. Savage*, *J. E. Cameron* & *F. E. Lanoker s.n.* (MO-130040); 3 mi. N of Spangle, *W. A. Weber* 2232 (MO).

23b. *Grindelia nana* var. *columbiana* Piper, Contr. U.S. Natl. Herb. 11: 556. 1906. Replaced name: *Grindelia discoidea* Nutt., Trans. Amer. Philos. Soc. 7: 315. 1840, nom. illeg., non *Grindelia discoidea* Hook. & Arn., Companion Bot. Mag. 2: 45. 1836. *Grindelia nana* Nutt. var. *discoidea* (Nutt.) A. Gray, Syn. Fl. N. Amer. 1(2): 119. 1906, nom. illeg. *Grindelia columbiana* (Piper) Rydb., Bull. Torrey Bot. Club 37: 128. 1910. TYPE: U.S.A. Oregon: Vancouver, *T. Nuttall* s.n. (holotype, PH [barcode] 00047854!; isotype, GH [barcode] digital image!).

Heads discoid. Chromosome number: $2n = 12$ (Cronquist, 1994: 256, sub *Grindelia columbiana* (Piper) Rydb.).

Iconography. Cronquist (1994: 257), sub *Grindelia columbiana*.

Distribution and habitat. *Grindelia nana* var. *columbiana* grows on sandy or gravel soils, along streams, from 30 to 700 m, in Washington and Oregon (U.S.A.).

Phenology. *Grindelia nana* var. *columbiana* has been collected in flower late June to August.

Etymology. The original name of the variety is taken from the Latin “discoideus,” which in the Compositae refers to the lack of ligulate florets, with all the florets regular and alike. The replacement name derives from the type locality.

Common name. Columbia River gumweed (<<http://plants.usda.gov/>>).

Discussion. When Nuttall (1840) described *Grindelia discoidea* he was unaware of the prior blocking name published by Hooker and Arnott four years earlier. It was Piper who offered the replacement name, although he indicated no rank for the trinomial when published in 1906. Gray’s use of the infraspecies at the varietal rank is continued herein.

Additional specimens examined. U.S.A. **Oregon:** Portland, dry rocky bluffs, *L. F. Henderson* 435 (MO); lowest Albina, *E. P. Sheldon* 10960 (MO). **Washington:** Benton Co., Kennewick, *N. Jones* 354 (PH); Columbia River shoreline, N of 100-D area, *C. Baird* 1397 (NY); Chelan Co., Wenatchee, 26 Sept. 1901, *L. M. Umbach* s.n. (PH); Klickitat Co., Sept. 1883, *W. N. Suksdorf* s.n. (PH); drying up ponds among sagebrush, *J. W. Thompson* 11119 (MO); Lincoln Co., sagebrush plains near Wilbur, *J. W. Thompson* 7164 (MO, PH); Yakima Co., *J. S. Cotton* 780 (MO).

24. *Grindelia nelsonii* Steyermark, Ann. Missouri Bot. Gard. 21: 471. 1934. TYPE: Mexico. Michoacán: Los Reyes, 8–12 Feb. 1903, *E. W. Nelson* 6864 (holotype, US [barcode] 00127644 digital

image!; isotypes, GH [barcode] 00008450!, NY [barcode] 00169634 digital image!).

Perennial subshrubs, 0.4–0.5 m; stem 1, erect, ramified, with scattered simple hairs. Leaves herbaceous, sessile, oblong to obovate-elliptic, $1\text{--}7.5 \times 0.3\text{--}1.2$ cm, scarcely clasping; blade apex acute to acuminate, margin serrate, teeth ending in a group of sessile glandular trichomes, with scattered sessile glandular trichomes and simple hairs on both blade surfaces. Heads radiate, pedunculate, 3–5 cm diam.; involucre hemispheric-campanulate, moderate to scarcely resinous, $8\text{--}13 \times 15\text{--}25$ mm; phyllaries in 4 or 5 subequal series, acuminate, linear-elliptic, 4–9 mm, erect, glabrous; acumen triangular, reflexed, flat, with sessile glandular trichomes; outer phyllaries with acumen very long and narrow. Ray florets 25 to 30; tube glabrous, ligule narrowly elliptic, 17–22 mm, apex entire. Disk florets with corolla 3.5–5.5 mm, with an abruptly ampliate throat. Achenes subquadrate, brown, 2.5–4 mm, smooth or longitudinally striate with shallow transverse incisions at the top, apex truncate or rounded; pappus of 2 or 3 bristles, 4–4.5 mm, smooth. Chromosome number not known.

Iconography. Steyermark (1934: 465, fig. 6).

Distribution and habitat. *Grindelia nelsonii* is known only from the type specimen. It has been collected from Michoacán (Mexico).

Phenology. *Grindelia nelsonii* has been collected in flower in February.

Etymology. *Grindelia nelsonii* was named in honor of Edward William Nelson (1855–1934), an American naturalist and ethnologist who collected in Mexico from 1892 to 1906.

Discussion. *Grindelia nelsonii* is characterized by its large radiate heads (3–5 cm diameter), with acuminate phyllaries in subequal series, the toothed leaves ending in a group of sessile glandular trichomes. This species is similar to a sympatric species, *G. palmeri* Steyermark, with which it shares the marginal teeth of the leaves ending in a group of sessile glandular trichomes, and the broad heads with acuminate phyllaries arranged in subequal series. *Grindelia nelsonii* differs by the long and narrow acumen in the outer phyllaries (equal to or shorter than the base in *G. palmeri*), and the subquadrate, smooth or longitudinally striate achenes with shallow transverse incisions at the apex (vs. 2- or 3-angled, smooth or slightly rugose in *G. palmeri*).

25. *Grindelia oaxacana* G. L. Nesom, Phytologia 68: 323. 1990. Replaced synonym: *Grindelia micro-*

cephala DC. var. *montana* Steyerl., Ann. Missouri Bot. Gard. 21: 470. 1934. Blocking name: *Grindelia montana* Phil., Anales Univ. Chile 87: 429. 1894. TYPE: Mexico. Oaxaca: Mtns. San Juan del Estado, 7500 ft., 13 Aug. 1894, L. C. Smith 135 (holotype, GH [barcode] 00008449!; isotype, MEXU-528072 digital image!). Figure 12.

Subshrubs (annual, biannual, or perennial?; see Nesom, 1990), 0.4 m; stem 1, erect, ramified, densely covered by simple hairs and stipitate glandular trichomes. Leaves herbaceous, sessile, oblong-ovate, 2–5 × 0.8–2 cm, clasping, auriculate; blade apex obtuse, margin serrate, teeth blunt, with minute stipitate glandular trichomes on both blade surfaces. Heads radiate, sessile, 1.6–2 cm diam.; involucre hemispheric, resinous, 11–13 × 17–20 mm; phyllaries in 5 or 6 unequal series, graduated, acuminate, oblong-obovate, 2.5–3 mm, erect, glabrous; acumen flat to subterete, erect to strongly reflexed, with sessile glandular trichomes. Ray florets 16 to 22; tube glabrous, ligule narrowly elliptic, 14–16 mm, apex entire. Disk florets with corolla 5 mm, with an abruptly ampliate throat. Immature achenes with transverse incisions, apex truncate; pappus of 2 setiform awns, 4.2–4.5 mm, smooth. Chromosome number not known.

Distribution and habitat. *Grindelia oaxacana* has been collected from mountainous places, ca. 2250 m, in Oaxaca and Puebla (Mexico).

Phenology. *Grindelia oaxacana* has been collected from the beginning of June to August.

Etymology. The name of *Grindelia oaxacana* is taken from the state of Oaxaca, Mexico, where the type specimen was collected.

Discussion. Differentiating characters of *Grindelia oaxacana* include the sessile, radiate heads, with acuminate phyllaries, flat to subterete acumen in graduated series, and clasping, auriculate leaves with minute stipitate glandular trichomes on both surfaces, the marginal teeth with blunt apices. *Grindelia oaxacana* differs from the sympatric species *G. hirtella* and *G. inuloides* by the teeth of the leaves with blunt apices (vs. teeth ending in a sclerotic tip both in *G. hirtella* and *G. inuloides*) and the pappus with two setiform awns (vs. two or three bristles in *G. hirtella* and *G. inuloides*).

Additional specimens examined. MEXICO. **Oaxaca:** Tepelmeme Villa de Morelos, Cerro Verde, Tierra Colorada, P. Tenorio Lezama 20201 (MEXU). **Puebla:** open fields along rte. 150, ca. 8 mi. E of Puebla, R. Merrill King 2631 (TEX).

26. *Grindelia obovatifolia* S. F. Blake, J. Wash. Acad. Sci. 32: 147. 1942. TYPE. Mexico. Nuevo León: Mpio. Montemorelos, abundant throughout pine, oak, & oak–Douglas fir forest, E slope of Sierra de la Cebolla, 21 Aug. 1939, C. H. Mueller 2932 (holotype, US [barcode] 00127646 digital image!; isotype, GH [barcode] 00008451 digital image!). Figure 13.

Rhizomatous herbs, 0.3–0.5 m; stems 1 or 2, erect, not ramified, glabrous or with simple hairs. Leaves herbaceous, sessile; blade apex obtuse, margin crenate-serrate, teeth blunt indurate or ending in few sessile glandular trichomes, or in a sclerotic tip; basal leaves ovate-elliptic, 4–5 × 2–2.7 cm, blades attenuate into a pseudopetiole as long as the blade, with scattered stipitate glandular trichomes; cauline leaves obovate, 3.5–6 × 1.5–2.8 cm, with simple hairs and stipitate glandular trichomes and scattered sessile glandular trichomes. Heads radiate, pedunculate, 1.3–2.5 cm diam.; involucre hemispheric-campanulate, scarcely resinous, 7–9.5 × 5–7 mm; phyllaries in 5 or 6 unequal series, graduated, acuminate, elliptic, 8–15 mm, spreading, glabrous; acumen subterete, 1.5–2.5 mm, reflexed, with sessile glandular trichomes. Ray florets 17 to 20; tube glabrous, ligule linear-elliptic, 13–14 mm, apex entire. Disk florets with corolla 5–5.6 mm, with a gradually ampliate throat. Achenes elliptic, brownish, flat, 2- or 3-angled, 3–3.5 mm, with transverse incisions, apex truncate; pappus of 2 or 3 bristles, 4.2–4.7 mm, smooth. Chromosome number: $2n = 12$ (Zhao, 1996: 260).

Distribution and habitat. *Grindelia obovatifolia* has been collected from pine, fir, and oak forests, at elevations from 1600 to 2400 m, in Nuevo León (Mexico).

Phenology. *Grindelia obovatifolia* flowers from August to November.

Etymology. The specific epithet is taken from the Latin “obovatus,” meaning “obovate,” and “folius,” meaning “leaved,” which refers to the shape of the leaves.

Discussion. *Grindelia obovatifolia* is a quite distinct rhizomatous herb, with the basal leaves with attenuate blades in a pseudopetiole as long as the blade. The heads are radiate with acuminate phyllaries in graduated, five or six series. It differs from *G. robinsonii*, another rhizomatous herb from Mexico, by the pseudopetiolate basal leaves (vs. sessile leaves in *G. robinsonii*) and the presence of stipitate glandular trichomes (vs. the absence of stipitate glandular trichomes in *G. robinsonii*).

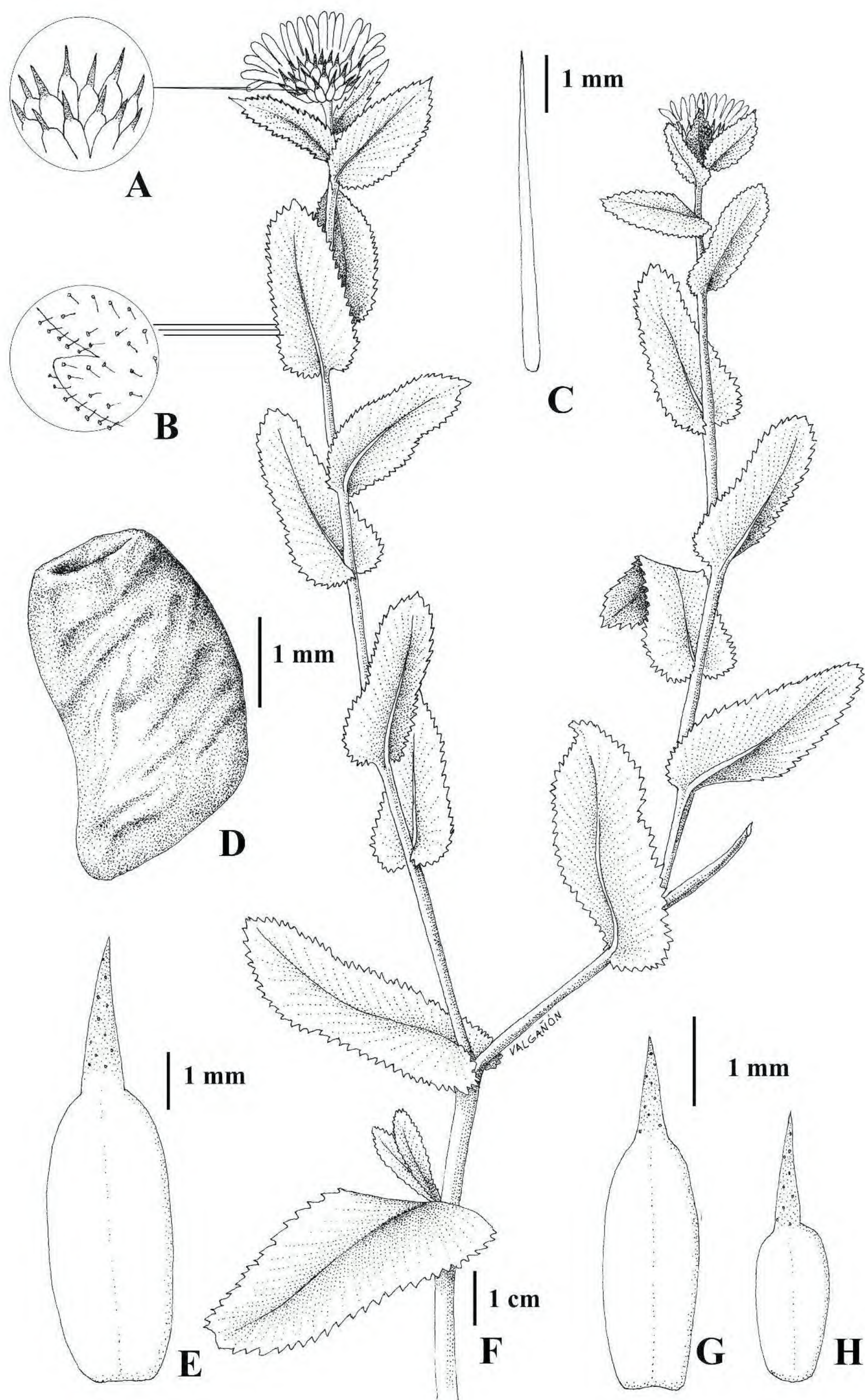


Figure 12. *Grindelia oaxacana* G. L. Nesom. —A. Part of the involucre, inner phyllary series represented. —B. Leaf tooth, showing blunt teeth, with minute stipitate glandular trichomes on both surfaces. —C. Pappus, showing one of two setiform awns. —D. Achene, showing transverse incisions. E, G, H. Representative phyllaries. —E. Inner series. —G. Middle series. —H. Outer series. —F. Fertile habit. Drawn from *R. Merrill King 2631* (TEX).

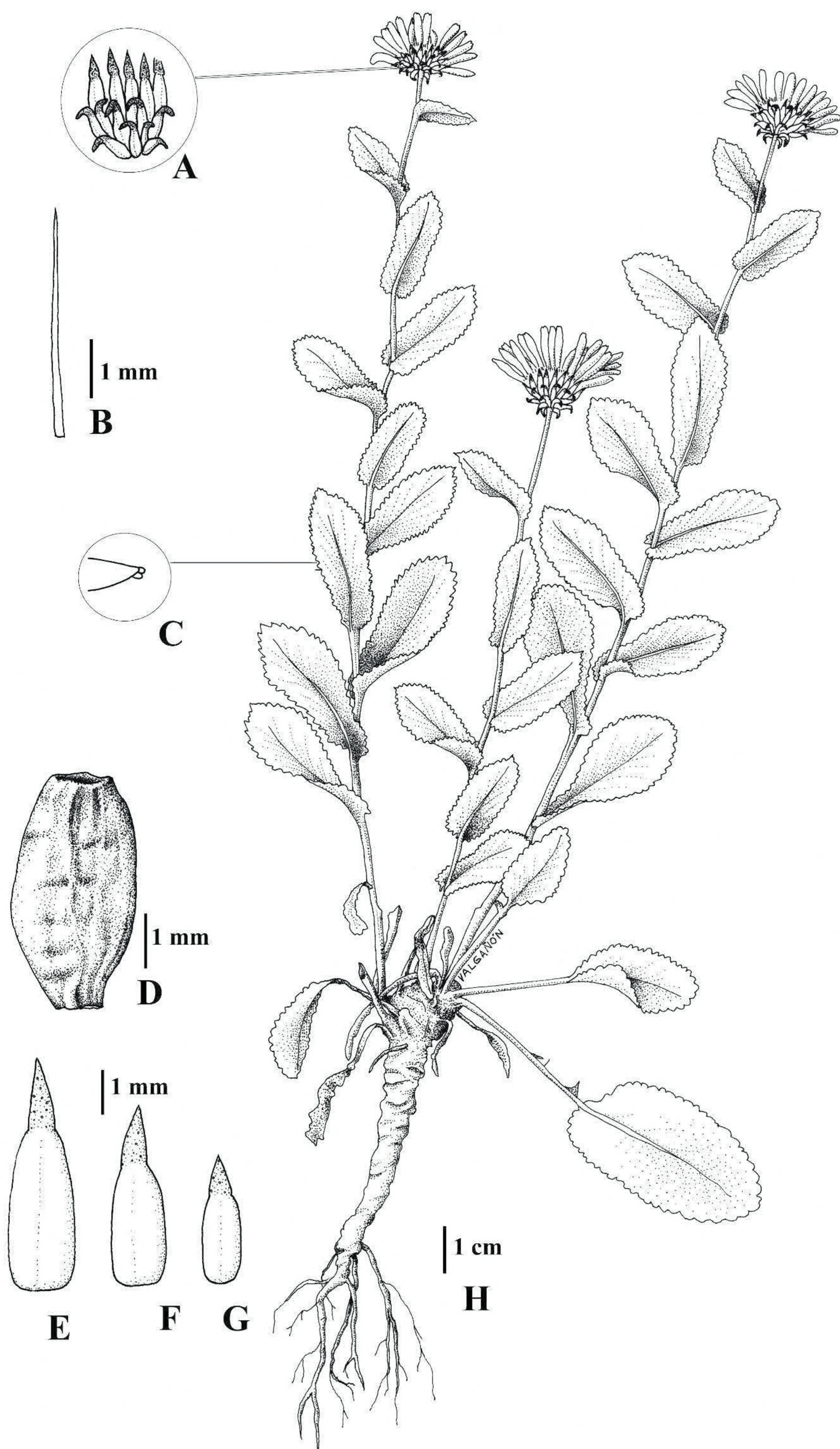


Figure 13. *Grindelia obovatifolia* S. F. Blake. —A. Part of the involucre, inner phyllary series represented. —B. Pappus bristle, showing one of two or three smooth bristles. —C. Leaf tooth, with the apex blunt and indurate or ending in a few sessile glandular trichomes (shown) or in a sclerotic tip. —D. Achene, showing the transverse incisions and two or three angles. E–G. Representative phyllaries. —E. Inner series. —F. Middle series. —G. Outer series. —H. Fertile habit. Drawn from *G. B. Hinton et al. 20024* (TEX).

Additional specimens examined. MEXICO. **Nuevo León:** Mpio. Aramberri, Aramberri, *G. B. Hinton et al.* 20024 (TEX); Mpio. Doctor Arroyo, ca. 35 km NE of Doctor Arroyo, along rd. ca. 0.5 mi. S of El Puerto, NE of San Antonio Pena Nevada, NW side of Cerro Peña Nevada, *G. L. Nesom & D. Morgan* 6789 (MO); Mpio. Galeana, above El Carrizo, *G. B. Hinton* 18618 (MEXU, TEX, XAL); Agua Blanca to San Miguel, *G. B. Hinton et al.* 21316 (MEXU); Mpio. Iturbide, Iturbide–Agua Blanca, *G. B. Hinton et al.* 21161 (TEX); La Purísima–Bella Vista, *G. B. Hinton* 21434 (MEXU, TEX); ca. 25 km S of Iturbide, along rd. 3.3 km W of Ejido La Purísima, *S. Sundberg et al.* 1890 (TEX); Mpio. Zaragoza, NW slope of Cerro Peña Nevada, ca. 0.5 rd. mi. below Puerto Pinos, on N side of the peaks, up from San Antonio Pena Nevada, *G. L. Nesom et al.* 7086 (TEX); Cerro El Viejo, *G. B. Hinton et al.* 2131 (MEXU), *G. B. Hinton et al.* 22398 (MEXU); ca. 3 air km. E of Zaragoza, W to WSW of Cerro El Viejo peak on local, *G. L. Nesom et al.* 7718 (TEX); Cañón La Boca, camino a Cola de Caballo, Laguna de Sánchez, *J. A. Villarreal et al.* 2351 (XAL).

27. *Grindelia oolepis* S. F. Blake, Proc. Biol. Soc. Washington 41: 139. 1928. TYPE: U.S.A. Texas: Cameron Co., El Jardín to Point Isabel Rd., 10 m, 5 Aug. 1923, *R. Runyon* 506 (holotype, US [barcode] 00127647 digital image!; isotype, GH [barcode] 00008434 digital image!).

Rhizomatous perennial herbs, 0.15–0.5 m; stems several, prostrate with tips rising upward erect, single or ramified, glabrous or with simple hairs in the distal portion. Leaves herbaceous, with sessile glandular trichomes on both blade surfaces, sometimes with simple hairs; basal leaves pinnatisect or deeply toothed, $2.5\text{--}6 \times 0.25\text{--}0.7$ cm, attenuate into a pseudopetiole; blade apex obtuse, mucronate, teeth ending in a sclerotic tip; cauline leaves sessile, linear to narrowly obovate, $0.7\text{--}4 \times 0.2\text{--}4.5$ cm, clasping; blade apex acute, mucronate, margin entire or toothed, teeth ending in a sclerotic tip. Heads discoid, pedunculate; involucre hemispheric to campanulate, resinous, $6\text{--}9 \times 8\text{--}15$ mm; phyllaries in 4 or 5 unequal series, graduated, subulate, oblong to ovate, 3–5.5 mm, erect, glabrous, apex flat with sessile glandular trichomes. Disk florets with corolla 4–5 mm, with a gradually ampliate throat. Achenes yellowish or yellow-brown, elliptic, 2- or 3-angled, smooth or somewhat rugose, apex truncate or coronate; pappus of 2 setiform awns or subulate scales, 4–4.5 mm, straight, smooth. Chromosome number: $2n = 12$ (Dunford, 1969: 20).

Iconography. Steyermark (1934: 518, fig. 24).

Distribution and habitat. *Grindelia oolepis* grows on clay soils and grasslands, from 0 to 20 m, in Texas (U.S.A.).

Phenology. *Grindelia oolepis* flowers from August to December.

Etymology. The specific epithet is taken from the Latin “oo-,” meaning “egg,” and from the Greek “lepis,” meaning “scale,” which refers to the ovate shape of the phyllaries.

Common name. Plains gumweed (<<http://hortiplex.gardenweb.com>>).

Discussion. *Grindelia oolepis* is a rhizomatous perennial herb immediately distinguished from all other herbaceous species of the genus with its pinnatisect or deeply toothed basal leaves, and discoid heads with subulate phyllaries in graduated, four or five series.

Additional specimens examined. U.S.A. **Texas:** Cameron Co., Brownsville, 14 Nov. 1933, *R. Runyon & J. A. Steyermark* s.n. (MO-2762590); SE corner of 1 E and St. Francis, *M. A. Wetter* 737 (MO); W end of Palm Blvd., Brownsville, *V. L. Cory* 51421 (GH); Jim Wells Co., 3 mi. W of Nueces–Jim Wells Co. line W of Agua Dulce, *M. A. Wetter* 2035 (NY); Nueces Co., Agua Dulce, *B. C. Tharp* 44451 (MO); near Agua Dulce, *M. A. Wetter* 738 (MO); ca. 1/4 mi. S of St. Paul on Hwy. 181, *W. F. Mahler* 8653 (GH); San Patricio Co., Hwy. 234 betw. Odem & Edray, *M. P. Dunford & C. E. Freeman* 1156 (NY).

28. *Grindelia oxylepis* Greene, Pittonia 4: 42. 1899. TYPE. Mexico. Chihuahua: wet places, plains near Chihuahua, 17 Sep. 1886, *C. G. Pringle* 748 (holotype, NDG-53620 digital image!; isotypes, BRIT-23676 digital image!, E [barcode] 00385585 digital image!, GH [barcode] 00008452 digital image!, MICH [barcode] 1107422 digital image!, MO-193878!, NY [barcode] 169636 digital image!, NY [barcode] 169637 digital image!, PH [barcode] 47864 digital image!, RSA [barcode] 0001226 digital image!, US [barcode] 00056850 digital image!, US [barcode] 01417150 digital image!).

Grindelia oxylepis Greene f. *capitellata* Steyermark, Ann. Missouri Bot. Gard. 21: 490. 1934, syn. nov. TYPE: Mexico. Durango: Mapimi & vic., 21–23 Oct. 1898, *E. Palmer* 520 (holotype, GH [barcode] 00008453!; isotypes, MO-193820!, NY [barcode] 169638 digital image!, US [barcode] 00127650 digital image!).

Annual or biannual subshrubs, 0.2–0.55 m; stems 1, rarely 2, erect, ramified, glabrous. Leaves subcoriaceous, sessile, oblong or obovate, $1\text{--}3 \times 0.3\text{--}0.8$ cm, clasping; blade apex obtuse, margin minutely serrate, teeth blunt or ending in a group of sessile glandular trichomes, less commonly spinulose, with sessile glandular trichomes in pits on both surfaces. Heads radiate, short pedunculate, 1.5–2 cm diam.; involucre urceolate, resinous, $7\text{--}10 \times 8\text{--}16$

mm; phyllaries in 4 or 5 unequal series, strongly graduated, subulate, narrowly elliptic, 4–8 mm, apex flat to subterete, mucronate, with sessile glandular trichomes in pits; the outer bracts spreading; the middle phyllaries and the upper erect. Ray florets 20 to 30; tube glabrous, ligule narrowly obovate, 7–9 mm, apex entire. Disk florets with corolla 4–6 mm, with an abruptly ampliate throat. Achenes brown, subquadrate, 1.5–3 mm, tuberculate, apex truncate or with a crown; pappus of 2 or 3 setiform awns, 4–6 mm, straight, smooth to barbellate. Chromosome number: $2n = 12$ (Semple et al., 1989: 302).

Iconography. Steyermark (1934: 495, fig. 13).

Distribution and habitat. *Grindelia oxylepis* grows on sandy and clay soils, in valleys and plains, from 800 to 1600 m, in Chihuahua, Coahuila, Durango, and San Luis Potosí (Mexico).

Phenology. *Grindelia oxylepis* flowers from April to November.

Etymology. The specific epithet is taken from the Greek “oxi-,” for “acute,” and “-lepis,” for “scale,” which refers to the mucronate apex of the phyllaries.

Common name. Mexican gumweed (<<http://hortiplex.gardenweb.com>>; <<http://data.gbif.org/species/13765388>>).

Discussion. *Grindelia oxylepis* is an annual or biannual subshrub, characterized by its radiate heads with an urceolate involucre and with subulate phyllaries in a strongly graduated, four or five series. *Grindelia oxylepis* f. *capitellata* was established by Steyermark (1934: 490) out of consideration for the smaller heads, noted as “campanulate-hemispherical to campanulate, 0.5–0.7 cm. high, 0.5–0.7 cm. in anthesis, becoming 1–1.3 cm. broad in fruit.” There does seem to be continuous variation for this character in *G. oxylepis*. We did study two specimens annotated as the form from the type locality in Durango (Bolsón de Mapimí: *J. Gregg* 444 and *J. Gregg* 627, MO), with heads that were equal in diameter to those seen in the species type.

Additional specimens examined. MEXICO. **Chihuahua:** Ahumada, in wet ditch along trail, *J. Henrickson* 5802a (TEX); Meoqui, *D. H. LeSueur* 974 (MO, TEX); 1 mi. S of Villa Ahumada along Chihuahua hwy. 45, 1/2 mi. E of hwy., *R. Spellenberg et al.* 4042 (TEX). **Coahuila:** Saltillo, rancho demostrativo Los Ángeles, 48 km S de Saltillo, *D. G. Arredondo* 227 (XAL); 25.4 mi. NW of San Pedro, in wet roadside ditch area, *J. Henrickson* 5988 (NY); Torreón, *L. Fisher* 44165 (MO); plains near Filipinas, *C. A. Purpus* 4701 (MO); General Cepeda, Presa El Tulillo, 9 km carr. a Hipólito del entronque carr. Saltillo–Torreón, *J. A. Villarreal & M. A. Carranza* 2312 (TEX, XAL). **Durango:** Bolsón de Mapimí, *J. Gregg* 444 (MO); valley of Nazas,

Bolsón de Mapimí, *J. Gregg* 627 (MO); old cornfields at city of Durango & vic., *E. Palmer* 174 (MO). **San Luis Potosí:** 1879, *J. G. Schaffner* 738 (NY); ca. 7 mi. N of San Luis Potosí on hwy. 57, *R. C. Jackson* 5097 (TEX); 8.7 mi. N of San Luis Potosí, *R. Kral* 27380 (MO); Mpio. Villa Hidalgo, ca. 20 mi. NW of San Luis Potosí on hwy. 57 to Matehuala, 9.8 mi. S of RR crossing at Ventura, *G. L. Nesom* 6660 with *J. Wells* (TEX).

29. *Grindelia palmeri* Steyermark, Ann. Missouri Bot. Gard. 21: 471. 1934, as “Palmeri.” TYPE: Mexico. San Luis Potosí: Álvarez, 28 Sep.–3 Oct. 1902, *E. Palmer* 163 (holotype, US [barcode] 00127652 digital image!; isotypes, BM [barcode] 001009430 digital image!, F [barcode] 0050297F digital image!, GH [barcode] 00008455!, MEXU-33213 digital image!, MO-193819!, NY [barcode] 00169640!).

Perennial shrubs, 0.1–0.5 m; stems 1 to 4, ascendent to erect, ramified, with scattered simple hairs, but villous near the heads. Leaves herbaceous, sessile, broadly oblong to obovate-elliptic, 1–7.5 × 0.3–1.5 cm, base somewhat subcordate, clasping; blade apex acute to obtuse, margin crenate-serrate, teeth ending in a few sessile glandular trichomes, simple hairs occasionally present near the nerves, scattered sessile glandular trichomes on both surfaces; cauline leaves progressively smaller. Heads radiate, pedunculate, 3–5 cm diam.; involucre hemispheric-campanulate, scarcely resinous, 8–13 × 15–25 mm; phyllaries in 4 or 5 subequal series, acuminate, linear-elliptic, erect, 4–9 mm, glabrous; acumen triangular, flat, reflexed, with sessile glandular trichomes; outer phyllaries with acumen equal to or shorter than base. Ray florets 25 to 35; tube glabrous, ligule narrowly elliptic, 10–22 mm, apex entire. Disk florets with corolla 3.5–5.5 mm, with an abruptly ampliate throat. Achenes yellowish brown or brown, elliptic, 2- or 3-angled, smooth or slightly rugose, apex truncate or rounded; pappus of 2 or 3 bristles, 4.5–5.5 mm, smooth. Chromosome number not known.

Iconography. Steyermark (1934: 465, fig. 8).

Distribution and habitat. *Grindelia palmeri* has been collected in oak, pine, and acacia forests, from 150 to 2500 m in Colima, Michoacán, and San Luis Potosí (Mexico).

Phenology. *Grindelia palmeri* has been collected in flower from July to October.

Etymology. *Grindelia palmeri* was named in honor of Edward Palmer (1829–1911), a British botanist who participated in the 1891 expedition to

Death Valley, California. He also collected specimens in Mexico and South America.

Common name. Cabezona (<http://www.thepanamanews.com/pn/v_08/issue_18/science_02.html>).

Discussion. *Grindelia palmeri* is a species with large radiate heads 3–5 cm in diameter, with the acuminate phyllaries in subequal, four or five series; the acumen of the phyllaries is triangular, flat, and reflexed, and the achenes are elliptic, 2- or 3-angled, and smooth or slightly rugose. It is similar to *G. nelsonii*, sharing the size of the heads, the arrangement of the phyllaries, and the pappus with two or three bristles. *Grindelia palmeri* differs by the form of the acumen of the outer phyllaries (vs. very long and narrow in *G. nelsonii*) and the achenes (vs. subquadrate, smooth or longitudinally striate, with transverse incisions at the apex in *G. nelsonii*).

Additional specimens examined. MEXICO. **Colima:** 3 km S of Michoacán–Colima border, *D. Burch* 5139 (MO). **Michoacán:** pasture, ca. 24 rd. mi. W of Jiquilpan, *A. Cronquist* 9759 (MO). **San Luis Potosí:** 22°N, *C. C. Parry & E. Palmer* 371 (MO); Mpio. Zaragoza, slopes, 10 km W of Santa Catarina on Mexican Hwy. 70, *D. E. Breedlove* 59348 with *F. Almeda* (TEX); microwave hill of Rte. 70 E of San Luis Potosí, W of Santa Catarina, *D. J. Loockerman* 40015 with *J. A. Soule* (TEX); 33 km E of San Luis Potosí or 1 km of Puerto de la Huerta on Hwy. 86, *K. Roe, E. Roe & S. Mori* 144 (TEX).

30. *Grindelia paysonorum* H. St. John, Res. Stud. State Coll. Wash. 1(2): 108–109. 1929, as “Paysonorum.” *Grindelia nana* Nutt. var. *paysonorum* (H. St. John) Steyerl., Ann. Missouri Bot. Gard. 21: 547. 1934. TYPE: U.S.A. Idaho: Nez Perce Co., dry ground, 900 ft., Lime Point, 9 May 1926, *H. St. John* 4361 (holotype, WS-48552!; isotype, RM [barcode] 0001124 digital image!).

Grindelia howellii Steyerl., Ann. Missouri Bot. Gard. 21: 549. 1934, as “Howellii.” Syn. nov. TYPE: U.S.A. Idaho: Kootenai Co., on dry arid bluff tops, St. Maries River, 10 Aug. 1894, *L. F. Henderson* 2791 (holotype, GH [barcode] 00037697!; isotypes, RM [barcode] 0001122 digital image!, RM [barcode] 0001122a digital image!, US [barcode] 00008208 digital image!).

Perennial subshrubs, 0.6–0.9 m; stems 1 or 2, erect, ramified, with stipitate glandular trichomes on the distal portion. Leaves herbaceous, sessile, oblong or elliptic, spatulate, 2.5–7 × 0.7–2.2 cm, base cuneate, somewhat clasping; blade apex acute to obtuse, margin entire, serrate or denticulate, teeth ending in a sclerotic tip, stipitate and sessile glandular trichomes present on both surfaces. Heads radiate, pedunculate to subsessile, 2.5–3 cm diam.; involucre hemispheric-campanulate, resinous, 8–15

× 12–20 mm; phyllaries in 6 or 7 unequal series, graduated, acuminate, elliptic to linear-elliptic, 3.5–10 mm, erect or spreading; acumen subterete, 2–4 mm, in the upper phyllaries revolute to reflexed, with sessile glandular trichomes. Ray florets 20 to 30; tube glabrous, ligule narrowly elliptic, 8–12 mm, apex entire. Disk florets with corolla 6–7 mm, with a gradually ampliate throat. Achenes whitish to yellow, elliptic, 4-angled, 4–4.5 mm, rugose or striate, with a crown at the apex; pappus of 2 to 5 setiform awns, 2.5–4 mm, straight to curved, smooth to barbellulate. Chromosome number not known.

Iconography. Steyerl. (1934: 540, fig. 30), sub *Grindelia howellii*.

Distribution and habitat. *Grindelia paysonorum* grows on disturbed soils, grasslands, open forests, and dry hillsides, from 900 to 1500 m, in Idaho and Montana (U.S.A.).

Phenology. *Grindelia paysonorum* has been collected in flower from July to September.

Etymology. The species was named in honor of Edwin Blake Payson (1893–1927), a botanist and professor of botany at the University of Wyoming (U.S.A.).

Discussion. Diagnostic features of *Grindelia paysonorum* include the radiate heads, the acuminate phyllaries, in graduated, six or seven series, the somewhat clasping leaves, with stipitate and sessile glandular trichomes scattered across both blade surfaces. *Grindelia howellii* closely corresponds to these characters, also described from Idaho.

Additional specimens examined. U.S.A. **Idaho:** Benehah Co., breaks of St. Maries River, *S. J. Brunsfeld* 79438 (NY); Idaho Co., at top of grade going down to Kamiah from Winona, *Q. Jones* 277 (NY); Lemhi Co., Salmon, *P. Edwin B. & L. B. Payson* 1883 (MO). **Montana:** Missoula Co., Holland Lake Rd., *J. R. Pierce* 1146 (NY); Powell Co., Ovando Valley, common along high water line of glacial ponds on Bandy Ranch SW of Upsata Lake, *P. Lesica* 5789 (NY); Greenough, 1 mi. E of Patonic turnoff, disturbed site, *J. R. Pierce* 1120 (MO).

31. *Grindelia pusilla* (Steyerl.) G. L. Nesom, Phytologia 73(4): 327. 1992. Basionym: *Grindelia microcephala* DC. var. *pusilla* Steyerl., Ann. Missouri Bot. Gard. 21: 467. 1934. TYPE: U.S.A. Texas: betw. Frio & Nueces Rivers, on rd. to Laredo, 27/28 Jan. 1880, *E. Palmer* 469 (holotype, GH [barcode] 00008433!; isotypes, MO-126251 digital image!, NY [barcode] 00169617!, US [barcode] 00127643 digital image!). Figure 14.

Annual subshrubs, 0.08–0.15 m; stems 1 to 7, erect, ramified, with simple hairs and stipitate glandular trichomes. Leaves herbaceous, elliptic, spatulate, blade apex acute or obtuse, margin crenate, teeth ending in a group of sessile glandular trichomes, with stipitate glandular trichomes and sessile glandular trichomes on both surfaces, occasionally in pits; basal leaves $3.5\text{--}6 \times 0.5\text{--}1$ cm, attenuate into a pseudopetiole; cauline leaves $1.2\text{--}1.5 \times 0.3\text{--}0.5$ cm. Heads radiate, pedunculate, 0.8–1.5 cm diam.; involucre hemispheric, resinous, $8\text{--}12 \times 8\text{--}13$ mm; phyllaries in 4 to 6 subequal series, subulate, the outer and middle narrowly ovate, erect or spreading, 8–10 mm, apex flat, erect or curved, 1.5–2 mm; the upper narrowly elliptic, 12 mm, erect. Ray florets 13 to 27; tube glabrous, ligule elliptic or ovate, 5–12 mm, apex entire or toothed. Disk florets with corolla 4–5 mm, with a gradually ampliate throat. Achenes stramineous to brown, obconic, 2- or 3-angled, 3–4.5 mm, sharply cut with transverse furrows, apex with a crown; the inner flattened; pappus of 2 or 3 setiform awns, 4–5.5 mm, straight, smooth. Chromosome number: $2n = 12$ (Zhao & Turner, 1993: 650).

Distribution and habitat. *Grindelia pusilla* has been collected on dry soils, in disturbed places, from 0 to 500 m, in Texas (U.S.A.) and Coahuila (Mexico).

Phenology. *Grindelia pusilla* flowers from March through June.

Etymology. The specific epithet is taken from the Latin “pusillus,” meaning “very small,” which refers to the size of the plants.

Common name. Little gumweed (<<http://plants.usda.gov/>>).

Discussion. We agree with Nesom (1992) in considering *Grindelia pusilla* a different taxon from *G. microcephala*, although both have smaller radiate heads less than 1.5 cm in diameter. *Grindelia pusilla* differs by its 2- or 3-angled, obconic achenes, sharply cut with transverse furrows (vs. 3- or 4-angled, globose achenes with smooth or slightly rugose surfaces in *G. microcephala*).

Additional specimens examined. U.S.A. **Texas:** Denton Co., Clear Creek Natl. Heritage Center, Collins Rd., Rocking Trail, s.d., *S. D. Lusk s.n.* (BRIT-24535); Lasalle Co., Cotulla, *E. J. Palmer 11295* (NY); Uvalde Co., 2 mi. W of Uvalde, rd. 90, *K. Bremer 2325* (MO).

32. *Grindelia robinsonii* Steyerl., Ann. Missouri Bot. Gard. 21: 459. 1934, as “Robinsonii.” TYPE: Mexico. San Luis Potosí: Agua del Medio, July 1911, *C. A. Purpus 5722* (holotype, US [barcode] 00127655 digital image!; isotypes,

BM [barcode] 001009431 digital image!, F [barcode] 0050298F digital image!, GH [barcode] 00008456 digital image!, MO-130322 digital image!, NY [barcode] 00169641!).

Rhizomatous perennial herbs, 0.15–0.55 m; stems 1, occasionally 2, erect, single or ramified, with vitreous simple hairs. Leaves subcoriaceous, sessile, oblong to oblong-elliptic, $1\text{--}5 \times 0.3\text{--}1.3$ cm, clasping; blade apex obtuse, margin crenate-serrate to minutely serrate, teeth ending in a sclerotic tip, simple hairs and scattered sessile glandular trichomes on both surfaces. Heads radiate, pedunculate, 1.6–2 cm diam.; involucre campanulate, resinous, $7\text{--}10 \times 10\text{--}16$ mm; phyllaries in 4 unequal series, strongly graduated, acuminate, linear to oblong-elliptic, 3–6.5 mm, glabrous; the outer bracts reflexed; the middle and the upper phyllaries spreading or erect; acumen subterete, erect, 1–2 mm, with sessile glandular trichomes. Ray florets 15 to 20; tube glabrous, ligule linear-elliptic, 5–7 mm, apex entire. Disk florets with corolla 4–4.5 mm, with an abruptly ampliate throat. Achenes light brown, subquadrate, 2.5–2.6 mm, slightly rugose, apex truncate; pappus of 2 to 5 bristles, 4–4.5 mm, smooth. Chromosome numbers: $n = 6$ (Powell & Turner, 1963: 135); $2n = 12$ (Zhao, 1996: 260).

Iconography. Steyermark (1934: 457, fig. 3).

Distribution and habitat. *Grindelia robinsonii* grows in pine and oak forests, and in grasslands with acacia, at ca. 2300 m in Hidalgo and San Luis Potosí (Mexico) (Nesom, unpublished).

Phenology. *Grindelia robinsonii* has been collected in flower from July to August.

Etymology. *Grindelia robinsonii* was named in honor of Benjamin Lincoln Robinson (1864–1935), curator of the Gray Herbarium at Harvard University and editor of the *Synoptical Flora of North America*, published in 1895–1897.

Discussion. *Grindelia robinsonii* is a rhizomatous herb characterized by its small radiate heads with strongly graduated acuminate phyllaries, in four series, with the outer phyllaries reflexed and a subterete acumen. Among rhizomatous herbs with radiate heads, *G. robinsonii* is similar to *G. obovatifolia* (from Nuevo León, Mexico), with which it shares small heads. *Grindelia robinsonii* differs by its leaves, which are sessile and have marginal teeth that end in a sclerotic tip (vs. attenuate basal leaves with a pseudopetiole as long as the blade, with marginal teeth that end in sessile glandular trichomes, as in *G. obovatifolia*). The achenes are

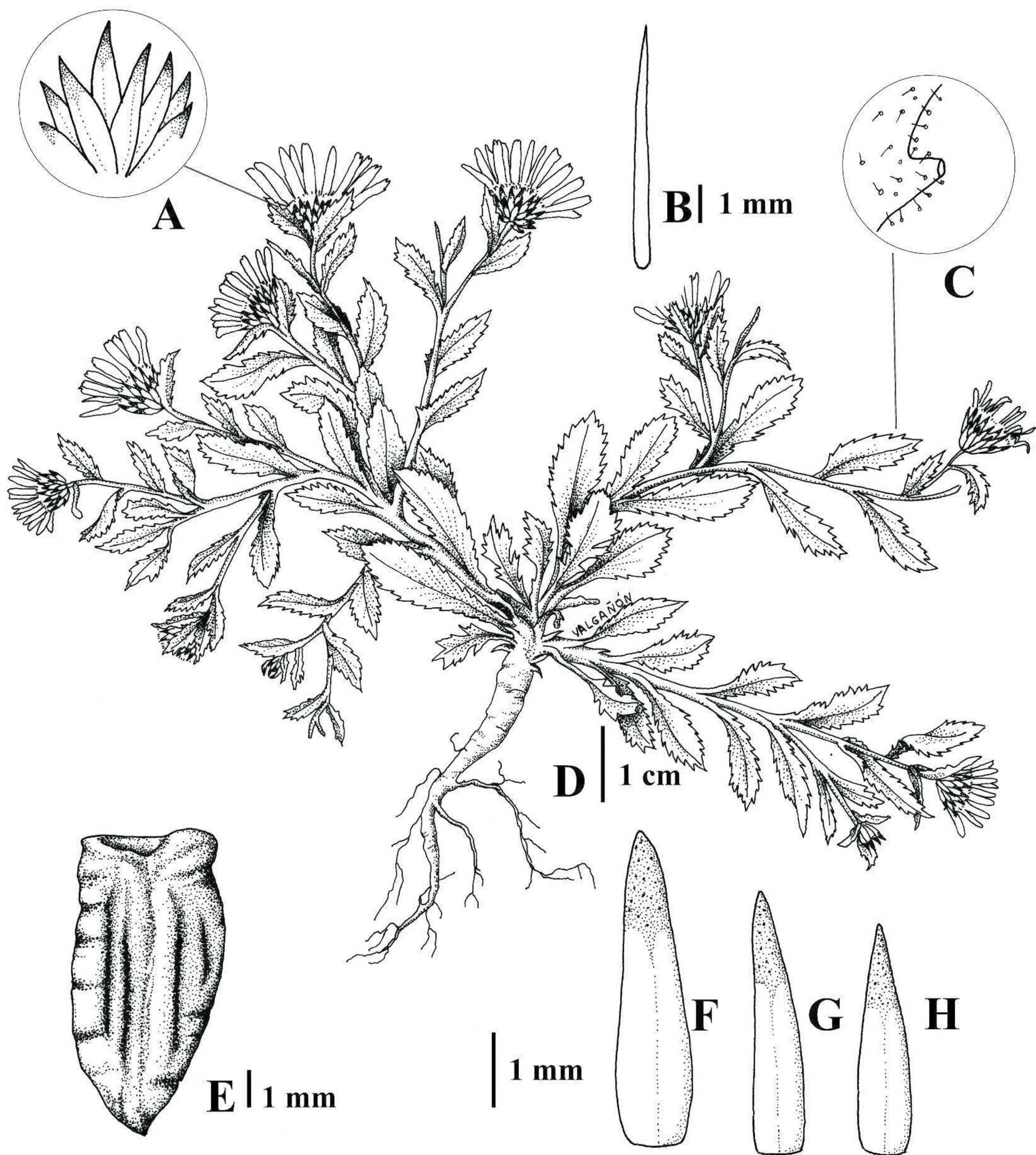


Figure 14. *Grindelia pusilla* (Steyerm.) G. L. Nesom. —A. Part of the involucre, inner phyllary series represented. —B. Pappus, showing one of two or three setiform awns. —C. Leaf tooth, ending in a group of sessile glandular trichomes, with stipitate glandular trichomes and sessile glandular trichomes. —D. Fertile habit. —E. Achene, showing two or three angles. F–H. Representative phyllaries. —F. Inner series. —G. Middle series. —H. Outer series. Drawn from K. Bremer 2325 (MO).

subquadrate and slightly rugose in *G. robinsonii*, but are elliptic, flat, and 2- or 3-angled, with transverse incisions in *G. obovatifolia*.

Additional specimens examined. MEXICO. **Hidalgo:** Hidalgo, pine woods, V. H. Chase 7376 1/2 (MO); dry bank of irrigating ditch, V. H. Chase 7266 (MO); Mpio. Jacala, L. Fisher 37145 (TEX). **San Luis Potosí:** Minas de San Rafael, C. A. Purpus 5151 (GH).

33. *Grindelia scabra* Greene, Bull. Torrey Bot. Club 25: 120. 1898. TYPE: U.S.A. New Mexico: Lincoln Co., White Mtns., 6300 ft., 28 July 1897, E. O. Wootton 224 (lectotype, designated by Nesom [1990: 320], NDG 53647 digital image!; isoelectotypes, MO-714081!, NDG-53648 digital image, NY [barcode] 00169622 digital image!, NY [barcode] 00169624 digital

image!, RM [barcode] 0001127 digital image!, RSA [barcode] 0001228 digital image!, US [barcode] 0030448 digital image!).

Grindelia neomexicana Wooton & Standl., Contr. U.S. Natl. Herb. 16: 178. 1913, syn. nov. *Grindelia scabra* Greene var. *neomexicana* (Wooton & Standl.) Steyerl., Ann. Missouri Bot. Gard. 21: 510. 1934. *Grindelia arizonica* A. Gray var. *neomexicana* (Wooton & Standl.) G. L. Nesom, Phytologia 68(4): 318. 1990. TYPE: U.S.A. New Mexico: mtns. N of Santa Rita, 23 Aug. 1900, *E. O. Wooton s.n.* (holotype, US [barcode] 00561099 digital image!).

Perennial subliguous herbs, 0.2–0.7 m; stems 1 to 4, erect, ramified, glabrous or with simple hairs. Leaves herbaceous, sessile, blade apex obtuse or acute, margin serrate or denticulate, teeth ending in a sclerotic tip, with short simple hairs and sessile glandular trichomes on both surfaces; basal leaves broadly elliptic to oblong-spatulate, $4\text{--}8.5 \times 2\text{--}2.5$ cm, attenuate into a pseudopetiole; blade apex obtuse to acute; cauline leaves ovate-oblong to elliptic, $3\text{--}3.5 \times 1\text{--}1.5$ cm, clasping; blade apex acute. Heads radiate, sessile, 2–4 cm diam.; involucre hemispheric, resinous, $7\text{--}11 \times 10\text{--}20$ mm; phyllaries in 4 to 6 subequal series, acuminate, linear, 7–11 mm, erect or spreading, margin scabrous; acumen filiform, terete or subterete, 2.5 mm, erect, with sessile glandular trichomes. Ray florets 17 to 30; tube glabrous, ligule narrowly elliptic, 12–17 mm, apex entire. Disk florets with corolla 6–7 mm, with a gradually ampliate throat. Achenes light brown, elliptic, 3- or 4-angled, 2.5–3 mm, smooth or slightly striate, apex obliquely truncate or forming a crown; pappus of 2 to 4 bristles, 4–6 mm, smooth to barbellulate. Chromosome number: $2n = 12$ (Dunford, 1986: 302).

Iconography. Greene (1898a: 120, figs. 1, 2).

Distribution and habitat. *Grindelia scabra* grows in plains and rocky hills, from 1400 to 2800 m, in New Mexico and Texas (U.S.A.).

Phenology. *Grindelia scabra* flowers from June to September.

Etymology. The specific epithet is taken from the Latin “scaber,” meaning “rough,” which refers to the pubescence of the leaves.

Common name. Rough gumweed (<<http://hortiplex.gardenweb.com>>).

Discussion. Useful characters for distinguishing *Grindelia scabra* include the radiate heads; the acuminate phyllaries with scabrous margins in subequal series; the phyllaries with a filiform acumen; and the leaves with marginal teeth that end in a sclerotic tip.

Nesom (1990) considered *Grindelia neomexicana* a variety of *G. arizonica*, and Strother and Wetter (2006) included this in the synonymy of *G. arizonica*. Nevertheless, the type of *G. neomexicana* corresponds with the diagnostic characters of *G. scabra*. Further, in the species-level taxon *G. arizonica*, the phyllaries have a flat acumen and are arranged in graduated series (vs. subequal in *G. scabra*). Thus, we agree with Steyermark in including *G. neomexicana* in the synonymy of *G. scabra*.

Additional specimens examined. U.S.A. **New Mexico:** Grant Co., Fort Bayard Watershed, *J. C. Blumer 4* (GH); Black Range W flank of Sawyer’s Peak, Silver Canyon, around Mitchell Gray’s cabin, 20 Aug. 1915, *H. A. Pilsbry s.n.* (PH-574225); Grant-Sierra Co., boundary betw. Sawyer’s Peak & Hillsboro Peak, 10 Oct. 1916, *H. A. Pilsbry s.n.* (PH-574223); Lincoln Co., White Mtns., *E. O. Wooton 372* (syntype for *Grindelia neomexicana* NY [barcode] 00169623, RSA [barcode] 0001229, TEX [barcode] 00373595); Otero Co., along US 82 just opposite entrance to Cloud Country Club Estates, *M. A. Wetter 590* (NY); Sierra Co., Kingston, *O. B. Metcalfe 1302* (GH); along NM 90, *C. C. Freeman & M. A. Wetter 2137* (NY). **Texas:** Jeff Davis Co., Davis Mtns., dry rocky ground on ridge above Little Ajuga Canyon, *J. A. Moore & J. A. Steyermark 3043* (MO).

34. *Grindelia squarrosa* (Pursh) Dunal, Mém. Mus. Hist. Nat. 5: 50. 1819. Basionym: *Donia squarrosa* Pursh, Fl. Amer. Sept. (Pursh) 2: 559. 1814. TYPE: U.S.A. South Dakota: prairies in camp near old Maha village, 17 Aug. 1804, *M. Lewis 40* (holotype, PH [barcode] 00047865!).

Biannual or perennial subshrubs, 0.15–1 m; stems 1 to several, erect or decumbent at the base, ramified, glabrous or with simple hairs. Leaves subcoriaceous; blade apex acute or obtuse, with sessile glandular trichomes in pits on both surfaces; basal leaves entire to pinnatisect, $6\text{--}8 \times 1.5\text{--}2$ cm, attenuate into a pseudopetiole; blade apex acute to obtuse, teeth acute and ending in a group of sessile glandular trichomes; cauline leaves sessile, oblong, elliptic, or obovate, $2.5\text{--}5 \times 0.25\text{--}2$ cm, clasping, auriculate or subauriculate; blade apex acute to obtuse, margin entire, crenate-serrate, serrate, or denticulate, teeth rounded to obtuse ending in a group of sessile glandular trichomes. Heads radiate or discoid, pedunculate; involucre broadly urceolate to hemispheric, resinous, $6\text{--}20 \times 8\text{--}28$ mm; phyllaries in 4 to 6 series, strongly graduated, acuminate, linear-elliptic to narrowly ovate, 4–12 mm, spreading or reflexed; acumen linear to narrowly triangular, terete to subterete, erect to spreading, 4 mm, with sessile glandular trichomes in pits. Disk florets with corolla 4–6 mm, with a gradually ampliate throat. Achenes brownish, 3- or 4-angled, elliptic, 2.5–3 mm, smooth, rugose, or slightly furrowed, apex truncate;

pappus of 2 or 3 setiform awns, curved, 3–5.5 mm, smooth to barbellulate.

Etymology. The specific epithet is taken from the Latin “suarrosus,” meaning “rough, with scales, tips, or bracts projecting outward at about 90°,” which refers to the spreading or reflexed phyllaries.

Discussion. *Grindelia squarrosa* is characterized by its acuminate phyllaries in graduated series and by its leaves with sessile glandular trichomes in pits on both surfaces and marginal teeth that end in a group of sessile glandular trichomes. The taxon is similar to *G. subdecurrens* by the leaves that bear sessile glandular trichomes in pits on both surfaces, and the marginal teeth that end in a group of sessile glandular trichomes; the heads in both species have acuminate phyllaries arranged in four to six strongly graduated series. However, *G. squarrosa* differs by its achene surfaces being smooth, rugose, or slightly furrowed (achenes have prominent longitudinal furrows in *G. subdecurrens*) and the pappus with curved, setiform awns (a pappus of two to four straight bristles in *G. subdecurrens*).

Three varieties and two forms are recognized within *Grindelia squarrosa*. The three varieties are distinguished in the key couplets below, with the forms considered under the autonymic variety.

- 1a. Heads radiate 34a. *G. squarrosa* var. *squarrosa*
- 1b. Heads discoid.
 - 2a. Involucre 8 mm broad 34b. *G. squarrosa* var. *eligulata*
 - 2b. Involucre 15–20 mm broad 34c. *G. squarrosa* var. *nuda*

34a. *Grindelia squarrosa* var. *squarrosa*.

Heads radiate, 2.2–3.3 cm diam. Ray florets 22 to 36, tube glabrous, ligule narrowly elliptic, 7–15 mm, apex entire. Achenes smooth or rugose.

Two forms are further distinguished in the couplet below.

- 1a. All leaves entire ... 34a(1). *G. squarrosa* f. *squarrosa*
- 1b. Basal leaves pinnatisect 34a(2). *G. squarrosa* f. *pseudopinnatifida*

34a(1). *Grindelia squarrosa* f. *squarrosa*.

Grindelia perennis A. Nelson, Bull. Torrey Bot. Club 26: 355. 1899, syn. nov. TYPE: U.S.A. Wyoming: Sweet-water River, 27 July 1898, A. Nelson 4988 (holotype, RM [barcode] 0001126 digital image!; isotypes, MO [barcode] 714079 digital image!, NY [barcode] 00169621!, UTC-171663 digital image!).

Grindelia serrulata Rydb., Bull. Torrey Bot. Club 31: 646. 1904, syn. nov. *Grindelia squarrosa* (Pursh) Dunal var. *serrulata* (Rydb.) Steyermark, Ann. Missouri Bot. Gard.

21: 482. 1934. TYPE: U.S.A. Colorado: Ft. Collins, 5000 ft., 10 Aug. 1891, J. M. Cowen s.n. (holotype, NY [barcode] 169625!).

Grindelia squarrosa (Pursh) Dunal var. *quasiperennis* Lunell, Amer. Midl. Naturalist 3: 143. 1913, syn. nov. TYPE: U.S.A. North Dakota: Butte, 2 Aug. 1909, J. Lunell 1040 (lectotype, designated by Cronquist [citing annotated by Mark Wetter, 1994: 256], MIN not seen).

Grindelia squarrosa (Pursh) Dunal f. *depressa* Steyermark, Ann. Missouri Bot. Gard. 21: 480. 1934, syn. nov. TYPE: U.S.A. Utah: alkali flat, 5 mi. W of Salt Lake City, 1300 m, 23 Aug. 1931, J. A. Moore & J. A. Steyermark 3768 (holotype, MO-1027218!).

Leaves entire with blade margin nearly entire, sharply toothed or denticulate. Chromosome numbers: $n = 6$ (Pinkava & Keil, 1977: 681, sub *Grindelia squarrosa* var. *serrulata*; Lane & Li, 1993: 542, sub *G. squarrosa* var. *serrulata*); $2n = 12$ (Morton, 1981: 361; Cronquist, 1994: 256).

Iconography. Cronquist (1994: 259).

Distribution and habitat. *Grindelia squarrosa* f. *squarrosa* grows on disturbed sandy soils, prairies, hillsides, and along streams, from 200 to 2900 m, in Arkansas, Colorado, Indiana, Iowa, Kansas, Massachusetts, Michigan, Montana, Nebraska, New Jersey, North Dakota, Pennsylvania, South Dakota, Texas, Utah, Wisconsin, and Wyoming (U.S.A.) and Coahuila (Mexico).

Phenology. *Grindelia squarrosa* f. *squarrosa* flowers from July to September.

Common name. Curly cup gumweed (<<http://hortiplex.gardenweb.com>>; <<http://plants.usda.gov/>>).

Discussion. In *Grindelia squarrosa* f. *squarrosa* the leaves and margin of the blade are variable in shape. *Grindelia perennis*, with slender, nearly entire leaves (Nelson, 1899: 356), and *G. serrulata*, with sharply toothed leaves (Rydb., 1904: 646), share the diagnostic characters of *G. squarrosa*. The same is accepted for the variety *quasiperennis* with denticulate leaves that narrow toward the base (Lunell, 1913: 143), which was included in the synonymy of *G. perennis* by Steyermark.

Fitting within the taxonomic variation encompassed by *Grindelia squarrosa*, variety *quasiperennis*, variety *serrulata*, and form *depressa* established by Steyermark (1934) are included in the synonymy of *G. squarrosa* var. *squarrosa*, within form *squarrosa*.

Strother and Wetter (2006) considered *Grindelia perennis* a synonym of *G. hirsutula*. Nevertheless, the type of *G. perennis* matches the diagnostic characters of *G. squarrosa* and differs from *G. hirsutula* in its acuminate phyllaries (vs. subulate in *G. hirsutula*), its

sessile glandular trichomes in pits on the leaves (vs. scattered and not in pits in *G. hirsutula*), and its leaves with marginal teeth terminated by a group of sessile glandular trichomes (vs. the sclerotic tip seen in *G. hirsutula*).

Additional specimens examined. U.S.A. **Arkansas:** sandy banks of Arkansas River, 20 mi. above Little Rock, *G. Engelmann* 650 (MO). **Colorado:** Chaffee Co., 12 mi. W of Salida, *J. A. Moore & J. A. Steyermark* 3781 (MO). **Indiana:** Lagrange Co., SE Ontario, *C. D. Chas* 36 (PH). **Iowa:** Sioux Co., sandy margin of Rock River, *J. L. Carter* 1961 (PH); Lee Co., dry ground, 24 Aug. 1992, *R. J. Bush s.n.* (MO-130269). **Kansas:** Geary Co., *F. C. Gates* 18989 (MO); Riley Co., prairie W of Manhattan, *F. C. Gates* 14967 (MO); prairie, *J. B. Norton* 218 (MO). **Massachusetts:** Barnstable Co., sandy roadside, W Dennis, *M. L. Fernald* 1078 (MO). **Michigan:** Midland Co., 4 mi. SE of Midland, *R. R. Dreisbach* 6967 (PH). **Montana:** Cypress Hills, Battle Creek, Ranger Station, low prairie, *A. J. Breitung* 5676 (MO); Sweetgrass Co., roadside, open grassland in foothills of Crazy Mtns. along Big Timber Creek, 6 Aug. 1945, *C. L. Hitchcock & C. V. Muhlick s.n.* (MO-1297352). **Nebraska:** Lancaster Co., Lincoln, Sep. 1898, *G. Hedgcock s.n.* (MO-130283); Scotts Bluff Co., 21 Aug. 1901, *C. F. Baker s.n.* (MO-130236); near bridge over a little creek outside Lincoln, *M. A. Wetter* 305 (MO). **Nevada:** Washoe Co., Reno, *A. A. Heller* 10639 (MO). **New Jersey:** Cape May Co., Dennisville, 10 Sep. 1916, *O. H. Brown s.n.* (PH). **Pennsylvania:** Westmoreland Co., New Alexandria, *F. W. Pennell* 2581 (PH); Philadelphia Co., The Neck, 20 June 1912, *W. Findlay s.n.* (PH); Morris Arboretum, *J. M. Fogg Jr.* 22274 (PH). **South Dakota:** Jackson Co., 6 mi. E of Belvidere, *G. J. Goodman* 3290 (MO); Walworth Co., S. S. Visser 3360 (MO). **Texas:** *J. Reverchon* 471 (MO). **Utah:** Salt Lake Co., Parley Canyon, 7 mi. E from Salt Lake City, 23 Aug. 1931, *J. A. Moore & J. A. Steyermark s.n.* (MO-1027268). **Wisconsin:** Portage Co., Stockton, *W. R. Taylor* 2802 (PH); Walworth Co., Tamarak Swamp, W of Lake Geneva, *J. A. Steyermark* 65926 (MO). **Wyoming:** Albany Co., Laramie, *A. Nelson & E. Nelson* 6894 (MO).

34a(2). *Grindelia squarrosa* f. *pseudopinnatifida* (D. Löve & J.-P. Bernard) Adr. Bartoli & Tortosa, comb. nov. *Grindelia perennis* A. Nelson f. *pseudopinnatifida* D. Löve & J.-P. Bernard, Svensk Bot. Tidskr. 53: 431. 1959. TYPE: Canada. Manitoba: Otterburne, roadside 1 mi. E of Otterburne, *J. P. Bernard* 58/263 (holotype, MT digital image!; isotypes, DAO digital image!, MT digital image!).

Basal leaves pinnatisect. Chromosome number not known.

Distribution and habitat. *Grindelia squarrosa* f. *pseudopinnatifida* is documented only from Manitoba Province (Canada).

Phenology. *Grindelia squarrosa* f. *pseudopinnatifida* has been collected in August.

Etymology. The specific epithet is taken from the Greek for “pseudo,” meaning “false,” and the Latin “pinnatifidus,” meaning “pinnately cleft,” which refers to the pinnatisect leaves.

Discussion. This form was originally established for *Grindelia perennis* by Löve and Bernard in 1959. Pinnatisect basal leaves were only observed in the two specimens from Manitoba Province, Canada, while all specimens studied from the United States have basal leaves with entire margins.

Additional specimens examined. CANADA. **Manitoba:** Otterburne, *J. P. Bernard* 58/510 (MT).

34b. *Grindelia squarrosa* var. *eligulata* (Steyerm.) Adr. Bartoli & Tortosa, comb. nov. Basionym: *Grindelia oxylepis* Greene var. *eligulata* Steyerm., Ann. Missouri Bot. Gard. 21: 490. 1934. *Grindelia eligulata* (Steyerm.) G. L. Nesom, Phytologia 68: 311. 1990. TYPE: Mexico. Coahuila: Saltillo, Sep. 1898, *E. Palmer* 316 (holotype, GH [barcode] 00008454!; isotypes, MO-193822!, MO-193823!, NY [barcode] 169639!). Figure 15.

Heads discoid; involucre 8 mm broad. Achenes with longitudinal and transverse furrows. Chromosome number: $2n = 12$ (Powell & Turner, 1963: 135, sub *Grindelia oxylepis* var. *eligulata*; Pinkava & Keil, 1977: 681, sub *G. oxylepis* var. *eligulata*).

Distribution and habitat. *Grindelia squarrosa* var. *eligulata* grows in valleys with pines and junipers, from 1000 to 1900 m, in Coahuila and Nuevo León (Mexico).

Phenology. *Grindelia squarrosa* var. *eligulata* flowers from May to August.

Etymology. The name of the variety is taken from the Latin for “ligulatus,” meaning “with ligule,” and the prefix “e-,” meaning “without or lacking,” which refers to the absence of ligulate florets.

Discussion. *Grindelia squarrosa* var. *eligulata* has small discoid heads. It was considered a variety of *G. oxylepis* by Steyermark (1934), based on its achenes with furrows. However, *G. squarrosa* differs from *G. oxylepis* in the shape of the phyllaries, with a terete acumen in *G. squarrosa* and a subulate acumen in *G. oxylepis*.

Additional specimens examined. MEXICO. **Coahuila:** San Antonio, *J. Gregg* 354 (MO); near Saltillo, 16 July 1848, *J. Gregg s.n.* (MO-130318); valley near Saltillo, *J. Gregg* 97 (MO); 22 km NW of Fraile, in mtn. valley, *L. R. Stanford, K. L. Retherford & R. D. Northcraft* 461 (MO); along Mexico 57, 0.1 mi. N of jct. of Mexico 57 & rd. to San Antonio, *C. C. Freeman & M. A. Wetter* 2041 (NY); Sierra Zapaliname, *G. B. Hinton* 20291 (MEXU). **Nuevo León:** along Mexico 57,

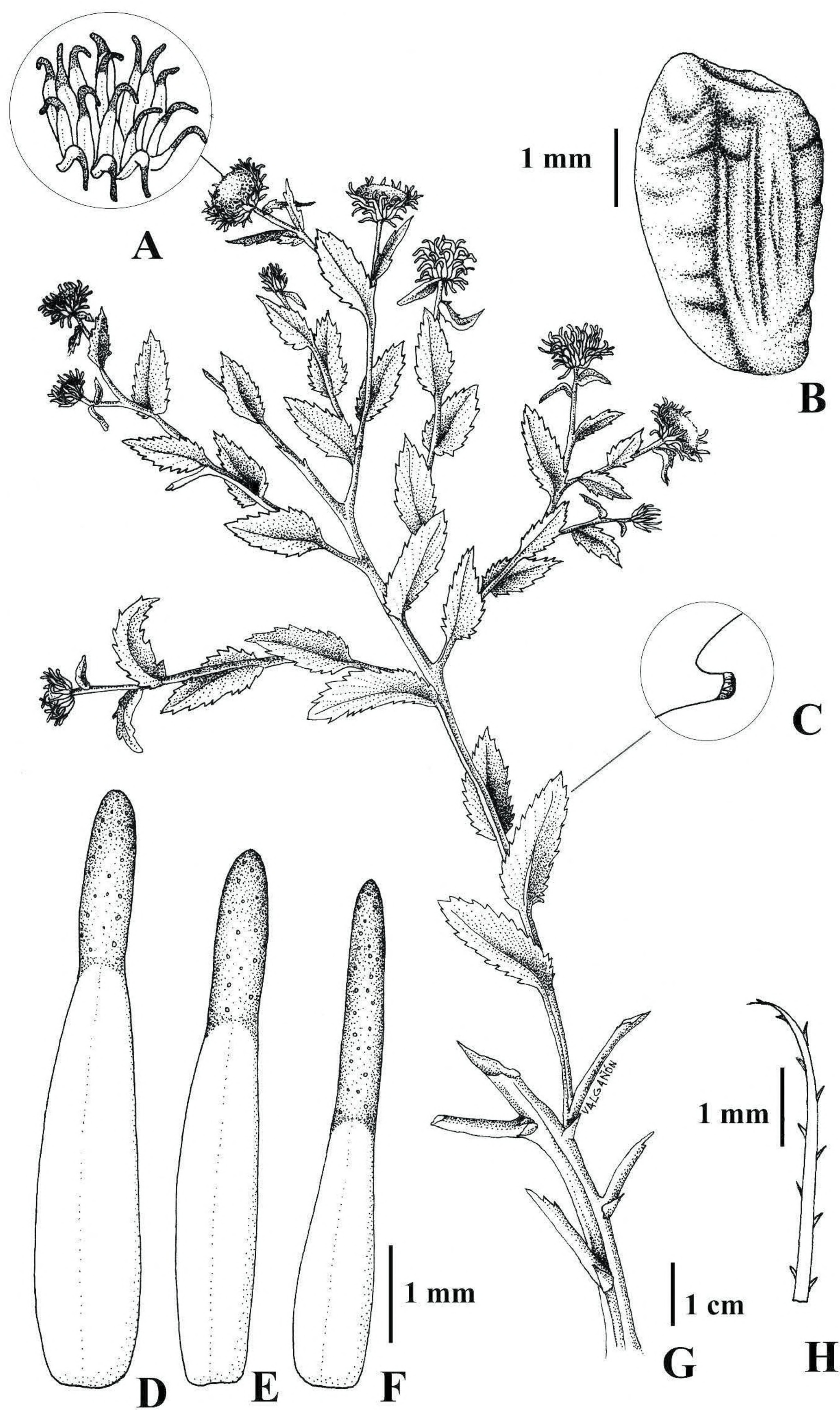


Figure 15. *Grindelia squarrosa* (Pursh) Dunal var. *eligulata* (Steyerm.) Adr. Bartoli & Tortosa. —A. Part of the involucre, inner phyllary series represented. —B. Achene, with furrows. —C. Leaf tooth, with rounded to obtuse apex, ending in a group of sessile glandular trichomes. D–F. Representative phyllaries. —D. Inner series. —E. Middle series. —F. Outer series. —G. Fertile habit. —H. Pappus, showing one of two setiform awns. Drawn from *E. Gregg* 97 (MO).

6.4 mi. S of the Coahuila–Nuevo León state line, *C. C. Freeman & M. A. Wetter 2054* (NY); Mpio. Galeana, near Rancho Aguillilla, *G. B. Hinton et al. 19581* (MEXU); N of Rancho Aguillilla, *G. B. Hinton 27658* (MEXU).

34c. *Grindelia squarrosa* var. *nuda* (Alph. Wood) A. Gray, Syn. Fl. N. Amer. 1: 118. 1884. Basionym: *Grindelia nuda* Alph. Wood, Bot. Gaz. 3: 50. 1878. TYPE: U.S.A. Oklahoma: Indian Territory, s.d., *T. E. Wilcox s.n.* (holotype, NY [barcode] 00169629!; isotype, NY [barcode] 00169620!). Figure 16.

Grindelia aphanactis Rydb., Bull. Torrey Bot. Club. 31: 647. 1904, syn. nov. *Grindelia nuda* Alph. Wood var. *aphanactis* (Rydb.) G. L. Nesom, Phytologia 68: 323. 1990. TYPE: U.S.A. Colorado: Durango, on dry gravelly soil, 21 July 1898, *C. F. Baker, F. S. Earle & S. M. Tracy 526* (holotype, NY [barcode] 169594!; isotypes, F [barcode] 0050283F digital image!, MICH [barcode] 1107420 digital image!, MO-714083 digital image!, NY [barcode] 169595!, RM [barcode] 0001113 digital image!, RM [barcode] 0001114 digital image!).

Grindelia pinnatifida Wooton & Standl., Contr. U.S. Natl. Herb. 16: 178. 1913, syn. nov. TYPE: U.S.A. New Mexico: Rio Arriba Co., open slopes, vic. of Chama, 2380–2850 m, 9 July 1911, *P. C. Standley 6606* (holotype, US [barcode] 00127653 digital image!).

Grindelia squarrosa (Pursh) Dunal f. *angustior* Steyerl., Ann. Missouri Bot. Gard. 21: 481. 1934, syn. nov. [described under *Grindelia squarrosa* var. *nuda*]. TYPE: U.S.A. Texas: Floyd Co., in roadside marsh 16 mi. E of Lockney on Quitaque Rd., 23 Aug. 1921, *R. S. Ferris & C. D. Duncan 3391* (holotype, MO-902235!; isotypes, CAS [barcode] 7834 digital image!, GH [barcode] 00008441!, NY [barcode] 169629!).

Heads discoid; involucre 15–20 mm broad. Stems generally solitary. Achenes longitudinally furrowed. Chromosome number: $2n = 12$ (Raven et al., 1960: 126, sub *Grindelia aphanactis*; Pinkava & Keil, 1977: 681, sub *G. aphanactis*).

Distribution and habitat. *Grindelia squarrosa* var. *nuda* has been collected from rocky and sandy soils, in prairies and open forests, in Arizona, Colorado, Kansas, New Mexico, Oklahoma, and Texas (U.S.A.). The variety has also been documented in pine and juniper forests, from 1200 to 1950 m, in Chihuahua and Coahuila (Mexico).

Phenology. *Grindelia squarrosa* var. *nuda* has been collected from May to October.

Etymology. The specific epithet is taken from the Latin “nudus,” meaning “naked,” which refers to the absence of ray florets.

Discussion. Nesom (1990) considered *Grindelia nuda* and *G. squarrosa* (the typical variety) as two different species, based on the shape of the achenes,

a monomorphic form in *G. nuda* and dimorphic (those of the outer florets 3-angled and the inner, 4-angled) in *G. squarrosa*. This difference in the variety *nuda* of *G. squarrosa* is due to the absence of ray florets that give rise to the 3-angled achenes.

The type of *Grindelia aphanactis*, collected in the state of Colorado, matches the diagnostic characters of the typical *G. squarrosa* with the exception of the absence of ray florets, as in *G. squarrosa* var. *nuda*. It differs from the Mexican variety *eligulata* of *G. squarrosa* by the size of the heads.

In *Grindelia pinnatifida* the leaves are deeply toothed or pinnatisect, but the remaining characters correspond to those of the type of *G. squarrosa* var. *nuda*.

Additional specimens examined. MEXICO. **Chihuahua:** ca. 27 (air) mi. SSW of Columbus, *J. Henrickson 11213* (NY). **Coahuila:** Mpio. de Arteaga, Sierra Zapaliname, *R. Hilton et al. 20291* (GH). U.S.A. **Arizona:** Yavapai Co., roadside near Prescott, *J. A. Moore & J. A. Steyermark 3682* (MO). **Colorado:** Fremont Co., Coaldale, *J. A. Moore & J. A. Steyermark 3782* (MO); Montezuma Co., Cortez, *J. A. Moore & J. A. Steyermark 3775* (MO). **Kansas:** prairies, *A. Finch 6* (MO); Cullison Pratt Co., *M. W. Norris 197* (MO). **New Mexico:** Albuquerque Co., 19 Aug. 1883, *H. H. Rusby s.n.* (PH), *M. E. Jones 4140* (PH); San Miguel Co., Española, Santa Fe to Las Vegas, 7 Sep. 1881, *G. Engelmann s.n.* (MO-130063); 15 mi. NW of Las Vegas, *G. J. Goodman 2321* (MO); Union Co., along US 56/US 64, 3 km E of jct. with US 87 at Clayton Common but scattered in clay soil of ditch & adjacent pasture, *M. A. Wetter 502* (MO). **Oklahoma:** Comanche Co., dry open ground, granite areas, Wichita Mtns., Wichita Natl. Forest, *E. J. Palmer 41965* (MO); Greer Co., near Willow, *R. Stratton 332* (MO). **Texas:** Brown Co., dry open ground, Brownwood, *E. J. Palmer 11111* (MO); Childress Co., *Biology class 9014* (MO); Lipscomb Co., along Commission Creek, 3 mi. S of Higgins, forested area, *D. S. Correll 30251* (MO); Jeff Davis Co., Davis Mtns., along rd. to Toyahvale, 20 mi. from Ft. Davis, 10 June 1931, *J. A. Moore & J. A. Steyermark s.n.* (MO-1025879); Kendall Co., going W on Cascade, Caverns Rd., *M. A. Wetter 603* (MO); Llano Co., Enchanted Rock, *E. Whitehouse 9008* (MO); Potter Co., Amarillo, 1921, *M. Hebard s.n.* (PH).

35. *Grindelia subalpina* Greene, Pittonia 3: 297. 1898. TYPE: U.S.A. Wyoming: Laramie, 9 July 1896, *E. L. Greene s.n.* (holotype, NDG-53650 digital image!).

Grindelia platylepis Greene, Pittonia 3: 297. 1898. TYPE: U.S.A. Wyoming: Sherman, 29 July 1893, *E. L. Greene s.n.* (lectotype, designated here, NDG-53627 digital image!).

Grindelia erecta A. Nelson, Bull. Torrey Bot. Club 26: 356. 1899. *Grindelia subalpina* Greene var. *erecta* (A. Nelson) Steyerl., Ann. Missouri Bot. Gard. 21: 501. 1934. TYPE: U.S.A. Wyoming: Laramie Hills, 11 Sep. 1898, *A. Nelson 5306* (holotype, RM [barcode] 0001116 digital image!; isotypes, MO [barcode] 714074!, NY [barcode] 00169601!).

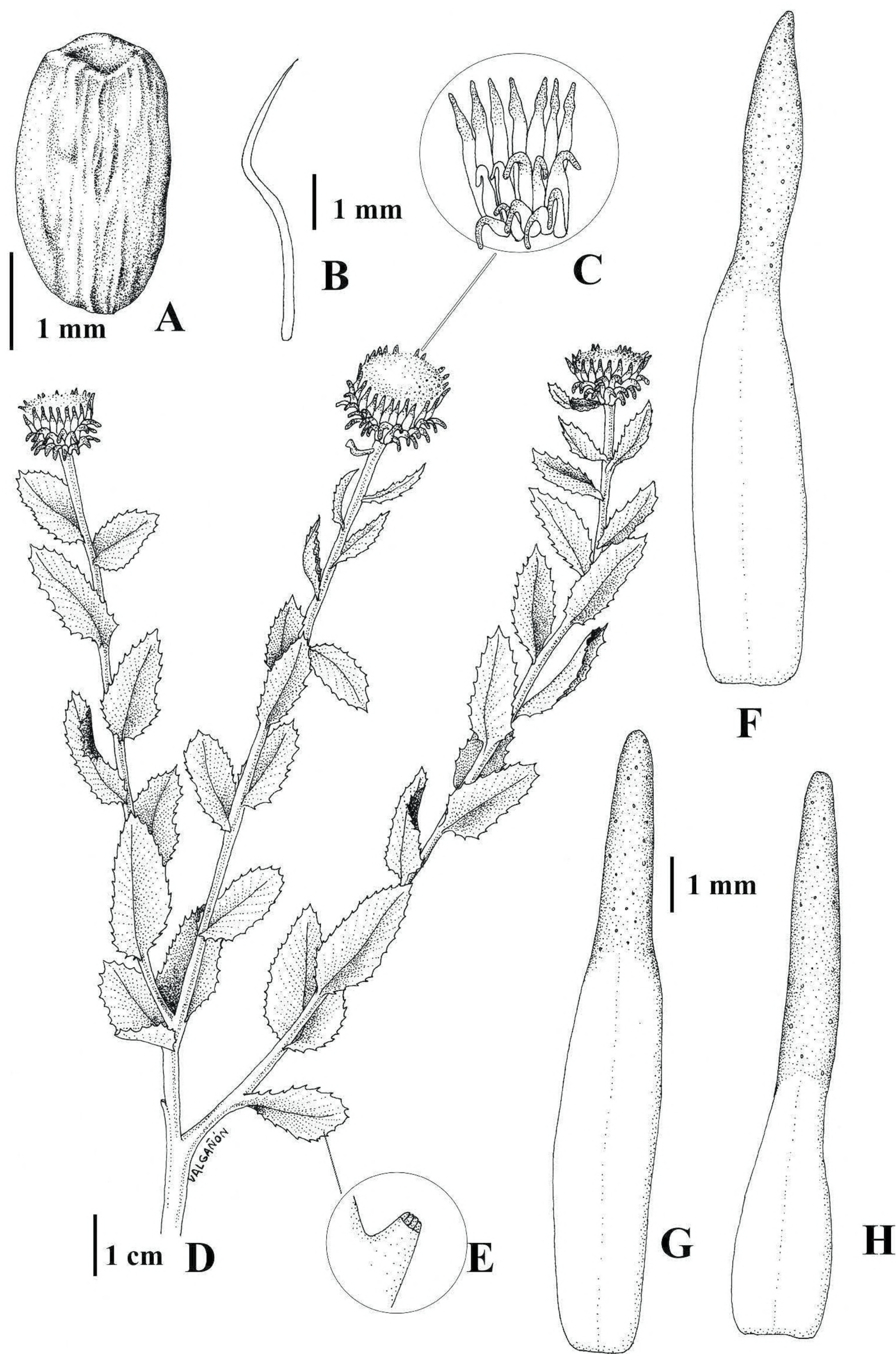


Figure 16. *Grindelia squarrosa* (Pursh) Dunal var. *nuda* (Alph. Wood) A. Gray. —A. Achene. —B. Pappus, showing one of two setiform awns. —C. Part of the involucre, inner phyllary series represented. —D. Fertile habit. —E. Leaf tooth, showing the rounded to obtuse apex, ending in a group of sessile glandular trichomes. F–H. Representative phyllaries. —F. Inner series. —G. Middle series. —H. Outer series. Drawn from *M. E. Jones 4140* (PH).

Grindelia acutifolia Steyerl., Ann. Missouri Bot. Gard. 21: 498. 1934, syn. nov. TYPE: U.S.A. New Mexico: Johnson's Mesa, 16 Aug. 1910, *E. O. Wootton* s.n. (holotype, US [barcode] 00127630!).

Perennial subshrubs, 0.15–0.6 m, with xylopodium; stems 1 to several, erect, ramified, glabrous. Leaves herbaceous, sessile, oblong to elliptic, 1.5–7 × 0.3–0.35 cm; blade apex acute or rounded, margin entire, minutely serrate or toothed, sometimes scabrous, teeth ending in a sclerotic tip, with sessile glandular trichomes on both surfaces; basal leaves with blades attenuate into a pseudopetiole; cauline leaves somewhat clasping. Heads radiate, pedunculate, 2.2–3.8 cm diam.; involucre broadly urceolate to hemispheric, resinous, 8–11 × 10–20 mm; phyllaries in 5 or 6 unequal series, graduated, acuminate, linear-oblong, 4–10 mm, erect; acumen terete, 2 mm long, reflexed or revolute, with sessile glandular trichomes. Ray florets 18 to 27; tube glabrous, ligule narrowly elliptic, 11–15 mm, apex entire. Disk florets with corolla 5–6 mm, with a gradually ampliate throat. Achenes light brown to stramineous, elliptic, 4-angled, 2.5–3 mm, smooth or slightly furrowed, truncate to weakly coronate; pappus of 2 to 8 setiform awns, 3.5–5.5 mm, straight, barbellulate. Chromosome number: $n = 6$ (Dunford, 1986: 302, sub *Grindelia acutifolia*).

Iconography. Steyermark (1934: 500, fig. 17).

Distribution and habitat. *Grindelia subalpina* has been collected in elevated planes, from 1600 to 2900 m, in Colorado, New Mexico, and Wyoming (U.S.A.).

Phenology. *Grindelia subalpina* flowers from July to August.

Etymology. The specific epithet is taken from the Latin “subalpinus,” meaning “growing below the alpine region marked by the timber line.”

Common name. Subalpine gumweed (<<http://hortiplex.gardenweb.com>>).

Discussion. Diagnostic characters for *Grindelia subalpina* include the reflexed or revolute, acuminate phyllaries, arranged in a graduated series, the flat phyllary acumen, and the leaves that have sessile glandular trichomes across both surfaces and not in pits. The species is similar to *G. havardii*, with which it shares basal leaves with blades attenuate into a pseudopetiole, the somewhat clasping cauline leaves, and the phyllaries of the involucre, which are acuminate and arranged in five or six graduated series. *Grindelia subalpina* differs by the teeth of the leaves that end in a sclerotic tip (vs. tipped by a

group of sessile glandular trichomes in *G. havardii*) and the acumen of the phyllaries is flat (vs. terete or subterete in *G. havardii*). The pappus consists of two to four setiform awns in *G. subalpina* and two bristles in *G. havardii*.

We agree with Wetter who considered (1985, in sched.) that the Green specimen (NDG-53627) represents the type of *Grindelia platylepis*, and the name is lectotypified herein.

Grindelia acutifolia matches the diagnostic characters of *G. subalpina*. Steyermark (1934: 499) distinguished *G. subalpina* from *G. acutifolia* by the number of the pappus awns (four to eight in *G. subalpina* instead of two or three in *G. acutifolia*). However, in the protologue of *G. subalpina*, Greene (1898b: 297) stated “bristles of the pappus 2 to 4.”

Additional specimens examined. U.S.A. **Colorado:** Boulder Co., meadows, near Middle St., Vrain Creek, 2 mi. W of Peaceful Valley P.O. near Raymond, *P. B. Green* 274 (PH); Clear Creek Co., mtns. about the headwaters of Clear Creek, dry places in valley near Empire, *H. N. Patterson* 235 (PH); El Paso Co., in Broadmoor Distr., Colorado Springs, *R. M. King & R. M. Garvey* 12699 (MO); Fremont Co., *E. L. Johnston* 335B (MO); Gilpin Co., on approach to Rollins Pass, on railroad grade, 1.5 mi. from Moffat Tunnel Rd. W of Rollinsville, 30 Aug. 1986, s. coll. (MO-3440525); along Rollins Pass Rd., *R. Merrill King & R. M. Garvey* 11914 (NY); Jefferson Co., pine jct., Woodcrest PK. access rd., *J. C. Semple & R. Brammall* 2708 (MO); Park Co., along US Hwy. 285 ca. 1/2 mi. E of Bailey, *R. Merrill King & R. M. Garvey* 12549 (MO). **New Mexico:** Albuquerque Co., *H. N. Rusby* 1555 (NY); Colfax Co., along NM 72, 11.5 mi. W of jct. NM 72 & NM 325 at Folsom, *M. A. Wetter* 908 (NY). **Wyoming:** Albany Co., Laramie, *A. Nelson & E. Nelson* 6865 (MO); vacant lots, *G. J. Goodman* 765 (MO); Laramie Co., near point where Tunnel Creek crosses Colorado, *D. Walter & B. Sears* 9195 (MO); N city limits of Cheyenne, along Dell Range Blvd., N of Cheyenne Municipal Airport, *R. M. King & R. M. Garvey* 12771 (MO); along old hwy. (Rd. 212-7) ca. 4 mi. E of Rd. 149-2, *R. M. King & R. M. Garvey* 12781 (NY).

36. *Grindelia subdecurrens* DC., Prodr. (DC.) 5: 315. 1836. TYPE: Mexico. Guanajuato: Mpio. de Guanajuato, ca. Villapando, s.d., *Méndez* s.n. (holotype, G-DC, IDC microfiche!; isotype, GH [barcode] 00008458!).

Perennial subshrubs, 0.2–0.3 m; stems 2 to 5, erect, ramified, glabrous. Leaves subcoriaceous, sessile, ovate-oblong, 1.5–4 × 0.3–0.8 cm, clasping or cordate at the base; blade apex obtuse, margin minutely serrate to crenate, sometimes scabrous, teeth ending in a group of sessile glandular trichomes, with sessile glandular trichomes in pits on both surfaces. Heads radiate, pedunculate, 1.5–2 cm diam.; involucre hemispheric, resinous, 8–10 × 13–25 mm; phyllaries in 4 to 6 unequal series,

strongly graduated, acuminate, oblong-elliptic, 2.5–8 mm, spreading; acumen subterete, 1–4 mm, reflexed, with sessile glandular trichomes in pits, and sometimes with long simple hairs. Ray florets 20 to 30; tube glabrous, ligule elliptic, 5–11 mm, apex entire. Disk florets with corolla 4–5 mm, with an abruptly ampliate throat. Achenes dark brown, broadly elliptic to subquadrate, 3-angled or slightly compressed, 2–2.5 mm, with prominent longitudinal furrows, apex truncate; pappus of 2 to 4 bristles, 3–5 mm, straight, smooth. Chromosome number: $2n = 24$ (Semple et al., 1989: 302).

Iconography. Steyermark (1934: 468, fig. 10).

Distribution and habitat. *Grindelia subdecurrens* grows on pasturelands and in clearings of juniper forests, from 1900 to 2500 m, in Zacatecas, Aguascalientes, San Luis Potosí, and Guanajuato (Mexico).

Phenology. *Grindelia subdecurrens* flowers from late June to September.

Etymology. The specific epithet is taken from the Latin “sub-,” meaning “somewhat” and “-decurrens,” meaning “decurrent.” It refers to the blade, which extends down along the stem.

Discussion. *Grindelia subdecurrens* is characterized by the radiate heads with acuminate phyllaries, arranged in strongly graduated series, with the acumen terete; its leaves show sessile glandular trichomes in pits on both surfaces. The taxon is similar to *G. camporum*, sharing ovate to oblong, clasping leaves with sessile glandular trichomes in pits on both blade surfaces, and with acuminate phyllaries of the involucre arranged in four to six unequal, graduated series. *Grindelia subdecurrens* differs by the size of plants (0.2–0.3 m vs. up to 1.5 m in *G. camporum*) and the heads (1.5–2 cm diameter vs. 2–3 cm diameter in *G. camporum*), and the teeth of the leaves that end in a group of sessile glandular trichomes (vs. in a sclerotic tip in *G. camporum*).

Additional specimens examined. MEXICO. **Aguascalientes:** Mpio. de Calvillo, Calvillo, C. L. Díaz Luna 2533 (TEX); 18.9 km W of Ciudad Aguascalientes, turnoff to Gracias a Dios, M. A. Lane 2689 (TEX); Hwy. 70 at turnoff to Gracias a Dios, ca. 10 mi. W of Aguascalientes, A. T. Whitemore 82-016 (TEX). **Guanajuato:** Guanajuato, 5 km al ENE de Guanajuato, R. Galván & J. D. Galván 3566 (XAL). **San Luis Potosí:** Mpio. de Charcas, 13.7 mi. N of Charcas, along a Tanque in pastureland, J. Henrickson B6382 (TEX); Sierra de Monte Grande, J. A. Reyes 267 (TEX). **Zacatecas:** 1 km E of turnoff to Station Frio from hwy. to Ciudad Durango to Ciudad Zacatecas, M. A. Lane 2702 (TEX); 12 km of Jerez, 10 km SW of Malpaso, 29 June 1979, R. Spellenberg et al. s.n. (TEX [barcode] 00136682); betw. Fresnillo & Sombrerete along Hwy. 45, .6 mi. W of

turnoff to Santa Rosa, S. Sundberg 2911 with M. Lavin (TEX); 14 mi. SW of Sombrerete, U. T. Waterfall 13810 (TEX); stony mountainside 2.2 mi. SE of Sombrerete, U. T. Waterfall 15578 (TEX).

37. *Grindelia sublanuginosa* Steyermark, Ann. Missouri Bot. Gard. 21: 458. 1934. TYPE: Mexico. Jalisco: S slopes of hills fronting Lake Chapala, 5 Jan. 1903, E. W. Nelson 6523 (holotype, US [barcode] 00127661 digital image!; isotype, NY [barcode] 00169644!).

Perennial shrubs, 0.4–1.5 m; stems several, erect, ramified, with abundant long simple hairs and short stipitate glandular trichomes. Leaves herbaceous, sessile, oblong-elliptic, $2-4 \times 0.5-1$ cm, clasping; blade apex acute to acuminate, margin minutely serrate, teeth ending in a sclerotic tip or in few sessile glandular trichomes, with simple hairs and stipitate glandular trichomes on both surfaces, densely villous at the base. Heads radiate, sessile or subsessile, 1–1.5 cm diam.; involucre campanulate, resinous, $8-10 \times 10-15$ mm; phyllaries in 3 or 4 unequal series, graduated, acuminate, 7–9 mm, erect to spreading, the outer with stipitate glandular trichomes; acumen narrowly triangular. Ray florets 8 to 30; tube glabrous, ligule narrowly elliptic, 9–11 mm, apex entire. Disk florets with corolla 3.5–4.5 mm, with a gradually ampliate throat. Achenes dull brown, subquadrate, 3.5–4.5 mm, transverse and sometimes longitudinal furrows, apex truncate; pappus of 4 bristles, 3.5–4.5 mm, straight, smooth. Chromosome number not known.

Iconography. Steyermark (1934: 457, fig. 2).

Distribution and habitat. *Grindelia sublanuginosa* has been collected from rocky soil, from 1500 to 1600 m, at Lake Chapala in Jalisco (Mexico).

Phenology. *Grindelia sublanuginosa* has been collected in flower during January.

Etymology. The specific epithet is taken from the Latin “sub-,” meaning “somewhat,” and “lanuginosus,” meaning “woolly,” which refers to the hair-covering of the stems and leaves.

Discussion. In *Grindelia sublanuginosa*, the differentiating characters include the radiate, sessile or subsessile heads, the phyllaries in graduated series, with a phyllary acumen that is narrowly triangular, and the leaves bearing simple hairs and stipitate glandular trichomes on both surfaces, densely villous at the base.

Additional specimen examined. *Grindelia sublanuginosa* is known only from the type.

38. *Grindelia tenella* Steyerl., Ann. Missouri Bot. Gard. 21: 464. 1934. TYPE: Mexico. Tamaulipas: de Victoria a Tula, Nov. 1830, *J. L. Berlandier* 766 (holotype, GH [barcode] 00008459!; isotypes, MO [barcode] 714073!, NY [barcode] 00169645!).

Annual herbs, 0.3–0.6 m; stems 1, sometimes 2, erect, ramified, glabrous or with dense simple hairs close to the head. Leaves herbaceous or subcoriaceous, oblong to obovate, 1.5–5 × 0.5–1.1 cm, clasping; blade apex acute or obtuse, margin denticulate or serrate-denticulate, teeth dull or ending in a sclerotic tip or in sessile glandular trichomes, with simple hairs and sessile glandular trichomes on both surfaces. Heads radiate, pedunculate, 2–2.5 cm diam.; involucre hemispheric, scarcely resinous, 6–8 × 9–13 mm; phyllaries in 4 or 5 unequal series, strongly graduated, acuminate, linear-elliptic, 3–4 mm, the outer bracts spreading and the middle bracts erect, with simple hairs; acumen subterete to terete, erect or somewhat curved, 1.5–2 mm, with scattered sessile glandular trichomes; the upper phyllaries narrowly elliptic, 8 mm, erect, with short acumen. Ray florets 15 to 18; tube glabrous, ligule narrowly elliptic, 7–9 mm, apex entire. Disk florets with corolla 4–5 mm, with an abruptly ampliate throat. Achenes dull brown, subquadrate, dimorphic, 2 mm, strongly furrowed to tuberculate, the innermost flattened with longitudinal superficial nerves, apex truncate; pappus of 2 or 3 bristles, 4–5 mm, straight, smooth. Chromosome number: $2n = 12$ (Zhao, 1996: 261).

Iconography. Steyermark (1934: 465, fig. 7).

Distribution and habitat. *Grindelia tenella* has been collected from grasslands with oak, and oak forests, from 200 to 1800 m, in Nuevo León and Tamaulipas (Mexico).

Phenology. *Grindelia tenella* has been collected in flower from June to late November.

Etymology. The specific epithet is taken from the Latin “tenellus,” meaning “delicate,” which refers to its slender habit.

Discussion. *Grindelia tenella* are annual herbs with radiate, pedunculate heads, with phyllaries having an acumen subterete to terete and arranged in graduated, four or five series; the achenes are strongly furrowed to tuberculate. The species is similar to *G. grandiflora* in that both are annual plants with sessile leaves, clasping, with sessile glandular trichomes on both blade surfaces, and have acuminate phyllaries arranged in graduated series.

Grindelia tenella differs from *G. grandiflora* by the phyllary acumen that is subterete to terete (vs. filiform in *G. grandiflora*) and by the surface of the achenes (vs. striate or furrowed in *G. grandiflora*).

Additional specimens examined. MEXICO. **Nuevo León:** Mpio. Monterrey, Fundición, *Fr. G. Arsène & B. Abbon* 101 (MO); El Cercado, *J. A. Duke* 3974 (MO); Iturbide, Hwy. 31 to Los Tejotes, *G. B. Hinton et al.* 28206 (MEXU). **Tamaulipas:** low grassland, Hacienda Santa Engracia, *V. H. Chase* 7578 (MO); El Mirador, *G. B. Hinton et al.* 24524 (MEXU, MO); rd. from Santa Engracia toward Dulces Nombres, 4.5 rd. mi. from lowermost crossing of Mimbres Creek, 12.5 rd. mi. NE of Paraje Los Caballos, *G. L. Nesom, M. Mayfield & J. Hinton* 7452 (MO); on broad dry arroyo 19 km SE of Miquihuana on rd. to Palmillas, *L. R. Stanford, K. L. Retherford & R. D. Northcraft* 867 (MO); 10 km NW of El Progreso, which is 18 km NW of Ocampo, *L. R. Stanford, K. L. Retherford & R. D. Northcraft* 1084 (MO); 5 km S of Hoja Verde, in arroyo, *L. R. Stanford, L. A. Taylor & S. M. Lauber* 2200 (MO).

39. *Grindelia tricuspis* (Sch. Bip.) Adr. Bartoli & Tortosa, comb. nov. Basionym: *Olivaea tricuspis* Sch. Bip., in Hooker's Ic. Pl. 12: 2–3, pl. 1103. 1876, non *Olivaea tricuspis* De Jong & Beaman, Brittonia 15: 89, fig. 1–9. 1963, nom. illeg. TYPE: Mexico. Jalisco: near Guadalajara, *W. Schaffner* 346 (holotype, P not seen; isotype, fragm. at US [barcode] 00124577 digital image!).

Oligonema heterophylla S. Watson, Proc. Amer. Acad. Arts. 26: 138. 1891. *Golionema heterophyllum* (S. Watson) S. Watson, Bot. Gaz. 16: 267. 1891 [epithet ending corrected by S. Watson, 1891: 267, to neuter ending, cf. Art. 62.2c.]. TYPE: Mexico. México: Atlacomulco, in shallow water, del Río Hondo, 30 Aug. 1890, *C. G. Pringle* 3236 (holotype, GH [barcode] 00010745 digital image!; isotypes, CAS [barcode] 0002852 digital image!, F [barcode] 0050822 digital image!, F [barcode] 0050823 digital image!, GH [barcode] 00010746 digital image!, COET [barcode] 001582 digital image!, JE [barcode] 00000622 digital image!, K [barcode] 000221400 digital image!, M [barcode] 0030095 digital image!, MEXU-33259 digital image!, MO-3726402!, NY [barcode] 00230805 digital image!, RSA [barcode] 0001438 digital image!, TEX [barcode] 00373648 digital image!, US [barcode] 00127629 digital image!).

Aquatic rhizomatous herbs, 1–1.2 m; stems several, ramified, glabrous, fistulose. Leaves herbaceous, sessile; blade apex acute, with stipitate glandular trichomes when young; basal leaves sunken, lobed or pinnatisect, 4–10 × 0.5–1.5 cm; basal cauline leaves elliptic, 4–10 × 0.5–1.5 cm, margin entire or with 3 teeth near the apex, margin serrate, teeth ending in a sclerotic tip; upper leaves linear to elliptic, 1–3.5 cm, clasping, sometimes auriculate. Heads radiate, pedunculate, 3–4 cm diam.; involucre hemispheric, resinous, 10–15 × 15–20 mm; phyllaries in 3 or 4 subequal

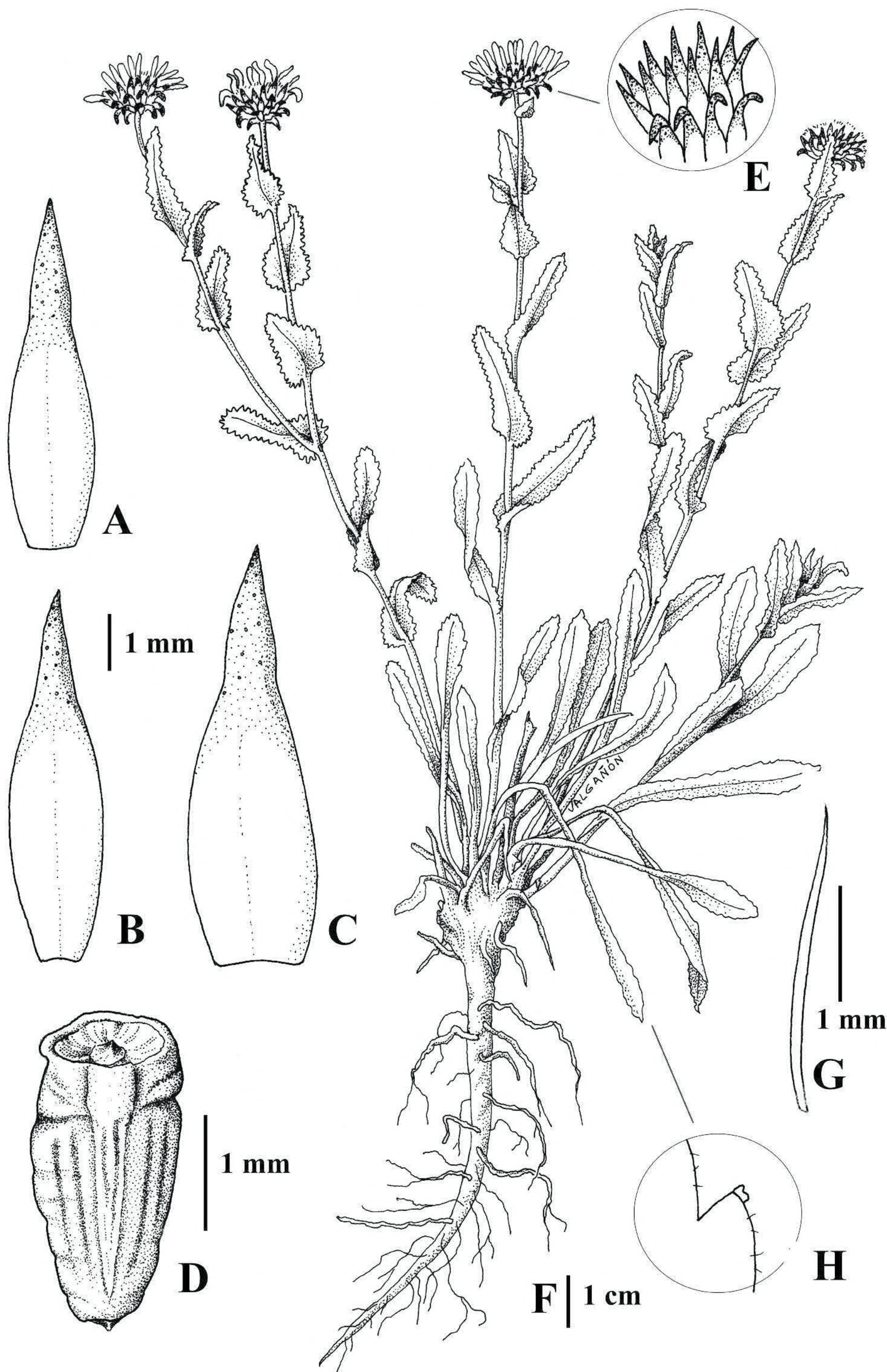


Figure 17. *Grindelia turneri* G. L. Nesom. A–C. Representative phyllaries. —A. Outer series. —B. Middle series. —C. Inner series. —D. Achene. —E. Part of the involucre; inner and middle phyllary series represented. —F. Fertile habit. —G. Pappus, one of two setiform awns. —H. Leaf tooth, ending in a group of sessile glandular trichomes. Drawn from *G. B. Hinton 17760* (TEX).

series, chartaceous and connate, narrowly triangular to narrowly ovate, 7–10 mm, subulate, erect, apex herbaceous, with stipitate glandular trichomes. Ray florets 25 to 35; tube with stipitate glandular trichomes, ligule linear-elliptic, 10–16 mm, apex entire or 3-toothed. Disk florets with corolla 4.5–5.5 mm, with an abruptly ampliate throat, tube with stipitate glandular trichomes. Achenes brownish green or light brown, quadrate, flattened, 2- or 3-winged, 2–3 mm, smooth, apex truncate; pappus of 5 to 12 bristles, 3–3.8 mm, barbellulate. Chromosome number: $n = 6$ (De Jong & Beaman, 1963: 90, sub *Olivaea tricuspis*).

Iconography. McVaugh (1984: 645, fig. 107), sub *Olivaea tricuspis*.

Distribution and habitat. *Grindelia tricuspis* grows on alkaline lowlands, from 1350 to 2040 m, in Aguascalientes, Jalisco, México, and Guanajuato (Mexico) (De Jong & Beaman, 1963).

Phenology. *Grindelia tricuspis* flowers from August to November.

Etymology. The specific epithet is taken from the Latin “tricuspis,” meaning “ended in three cusps,” which alludes to the apex of leaves.

Discussion. With its aquatic habit and fistulose stems, *Grindelia tricuspis* is similar to *G. leptocarpa*; both taxa are different from all other species in the genus (see Discussion under *G. leptocarpa*). In both species, the phyllaries are subulate and arranged in subequal series. These species differ in the basal leaves (sunken) that are lobed or pinnatisect in *G. tricuspis* (always entire in *G. leptocarpa*), the size of the heads (larger in *G. tricuspis* at 3–4 cm vs. 2–3 cm in *G. leptocarpa*) and the achenes that are 2- or 3-winged in *G. tricuspis* (vs. 2-angled in *G. leptocarpa*).

Beaman selected (in sched., 1963) the specimen GH-00010745 as holotype of *Oligonema heterophylla*, and his opinion is followed herein.

Additional specimens examined. MEXICO. **Aguascalientes:** El Llano, 1 km al NE de Palo Alto, J. Martínez R. 1281 (INEGI). **Jalisco:** in flats above El Molino, ca. 25 mi. of Guadalajara, R. McVaugh 16004 (NY); near Km. 57 just E of Aguascalientes state line, rd. from Ojuelos, R. McVaugh 16934 (NY); Jalisco, hilly country, O. Solbrig 4452 (NY); in shallow standing water at edge of Atotonilquillo, ca. 25 mi. SE of Guadalajara, A. Cronquist 9811 (MEXU, NY); Mpio. Aradas, ca. 13.5 km S of Santa María del Valle, R. McVaugh 26625 (NY).

40. *Grindelia turneri* G. L. Nesom, Phytologia 68: 313–314. 1990. TYPE: Mexico. Nuevo León: Mpio Galeana, betw. San Pablo & Tanquecillos, 0.5 mi. S of San Pablo, on rd. betw. San Rafael Jct. & Galeana, fallow fields in valley, pines on

high slopes of valley margins, 2320 m, 27 Aug. 1989, G. L. Nesom 7189 with J. Norris, J. Villarreal & M. Carranza (holotype, TEX [barcode] 00373596!; isotypes, ANSM not seen, COLO [barcode] 368464 digital image!, ENCB not seen, F [barcode] 0050299F digital image!, GH [barcode] 00008461!, KANU [barcode] 305133 digital image!, MEXU-400620 digital image!, MO [barcode] 193881 digital image!, NY [barcode] 00169646!, US [barcode] 00289325 digital image!, WAT digital image!, WIS not seen). Figure 17.

Perennial subshrubs, 0.15–0.35 m, with xylopodium; stems several, prostrate with tips rising upward, not or few ramified, with scattered small simple hairs. Leaves herbaceous or subcoriaceous, sessile, oblong to oblong-elliptic, 1.5–4.5 × 0.4–0.9 cm, blade apex acute or obtuse, margin toothed, scabrous, teeth ending in a group of sessile glandular trichomes, with simple hairs or minutely stipitate glandular trichomes on both surfaces; basal leaves with blades attenuate into a pseudopetiole, blade apex obtuse; cauline leaves clasping; blade apex acute. Heads radiate, pedunculate, 1.4–2 cm diam.; involucre hemispheric-campanulate, resinous, 9–10 × 12–15 mm; phyllaries in 3 or 4 subequal series, acuminate, narrowly ovate, 7–10 mm, the outer and middle spreading, the upper erect; acumen subterete, triangular, 2–2.5 mm, erect or slightly reflexed, with sessile glandular trichomes. Ray florets 18 to 23; tube glabrous, ligule elliptic, 12–18 mm, apex entire. Disk florets with corolla 4.8–5.2 mm, with an abruptly ampliate throat. Achenes brown, elliptic, slightly flattened to 3-angled, 2–3 mm, smooth or with short, shallow, transverse incisions, barely tuberculate; pappus of 2 setiform awns, 5–5.5 mm, straight, smooth. Chromosome number not known.

Distribution and habitat. *Grindelia turneri* has been collected from silt soils, arid hills, and pine and yucca forests, from 970 to 2600 m, northwest of Galeana, in Nuevo León (Mexico).

Phenology. *Grindelia turneri* flowers from March to November.

Etymology. *Grindelia turneri* was named in honor of Billie Lee Turner (1925–), an American botanist at Texas University who worked extensively on the flora of Mexico.

Discussion. *Grindelia turneri* is characterized by its acuminate phyllaries, with the subterete, triangular phyllary acumen arranged in subequal, three or four series. Its leaves bear either simple hairs or minutely stipitate glandular trichomes on both blade surfaces,

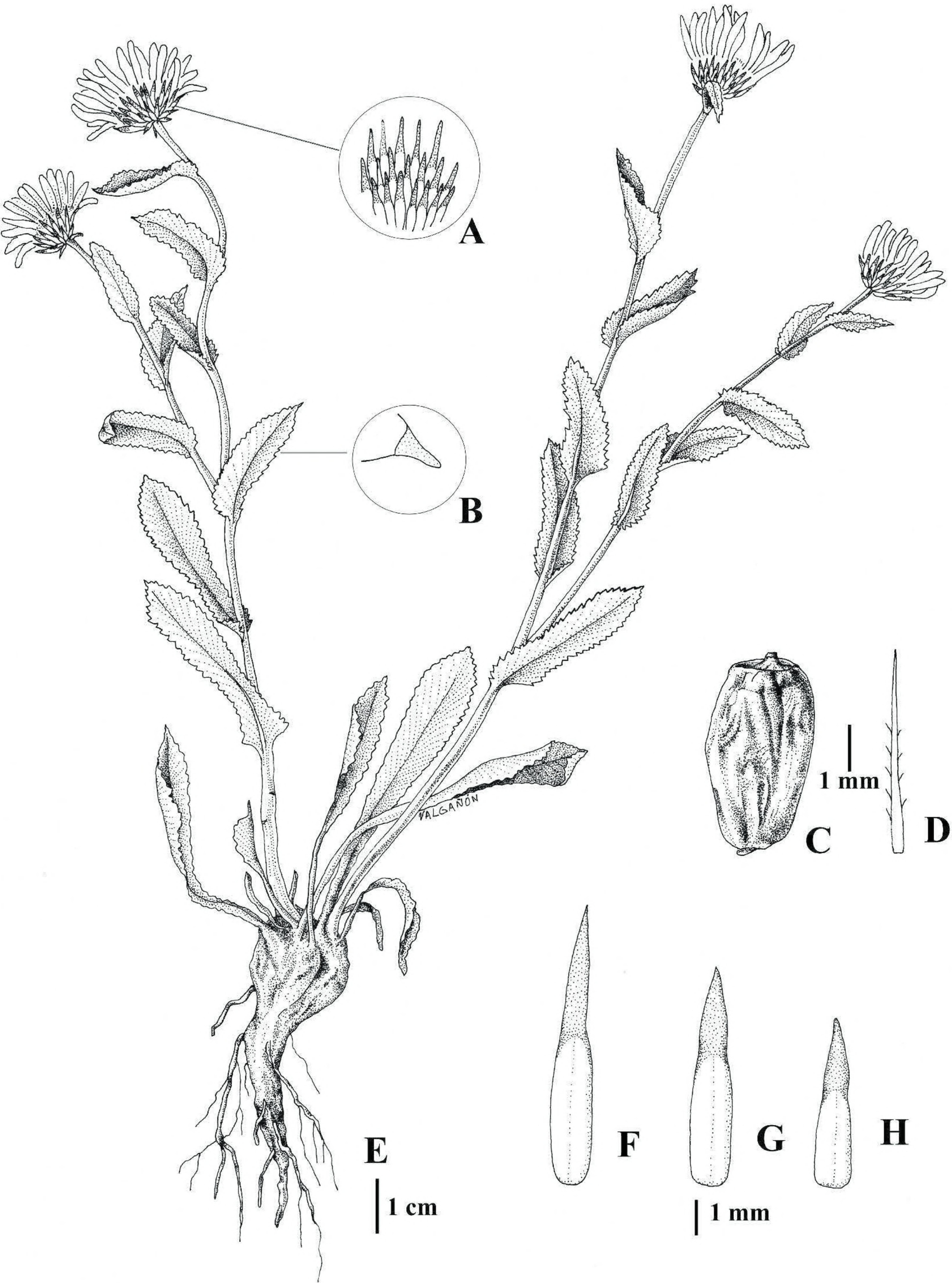


Figure 18. *Grindelia villarrealii* G. L. Nesom. —A. Part of the involucre, inner phyllary series represented. —B. Leaf tooth, showing the sclerotic apex. —C. Achene. —D. Pappus, one of two setiform, barbellate awns. —E. Fertile habit. F–H. Representative phyllaries. —F. Outer series. —G. Middle series. —H. Inner series. Drawn from G. L. Nesom et al. 7149 (TEX).

and the marginal teeth are tipped by a group of glandular trichomes. *Grindelia turneri* is most closely related to *G. villarrealii*, both from the Mexican state of Nuevo León, sharing perennial duration with a xylopodium, basal leaves with attenuate blades into the pseudopetiole and the cauline leaves clasping, and a pappus of two setiform awns. *Grindelia turneri* differs by the leaves with teeth ending in a group of sessile glandular trichomes (vs. in a sclerotic tip in *G. villarrealii*), an involucre with phyllaries in subequal series (vs. unequal series), and smooth awns of the pappus (vs. barbellate).

Additional specimens examined. MEXICO. **Nuevo León:** Mpio. Aramberri, *G. B. Hinton 20518* (MEXU); Mpio. Galeana, Tanquecillos, *G. B. Hinton 17760* (MEXU, TEX); San Pablo to San Pedro Sotolar, *G. B. Hinton et al. 27192* (MEXU); Agua Blanca, *G. B. Hinton 22268* (TEX); a long gravel rd. 8.7 mi. E of the jct. of rd. & Mexico 57, *C. C. Freeman & M. A. Wetter 2056* (TEX); along rd. from San Rafael to Derecho de Marzo & Galeana, *J. Grimes et al. 2278* (TEX); 5.6 mi. ESE of San Pablo, E of San Rafael at jct. on hwy. 57, *G. L. Nesom 5281 with D. Morgan* (TEX); ca. 9 km S of San Rafael along Hwy. 57 to W San Roberto Jct. Broad Valley (Valle Potosí), W of town of San Pablo, on rd. from San Rafael jct. overlooking San Pablo, *G. L. Nesom et al. 7184* (TEX); 2 mi. S of Tanquecillos on rd. betw. San Rafael jct. & Galeana, *G. L. Nesom et al. 7192* (MO); 20.6 mi. N of San Roberto jct. along hwy. 57 to Saltillo, 50 m S of Km. 162 along E side of rd., *S. Sundberg 3131 with M. Lavin* (TEX); Socorro to San Pablo, *G. B. Hinton 25402* (MEXU); Rancho Aguillilla, *G. B. Hinton 19481* (MEXU).

41. *Grindelia villarrealii* G. L. Nesom, *Phytologia* 73: 264–266. 1992. TYPE: Mexico. Nuevo León: Mpio. de Zaragoza, ca. 2–3 mi. N of Siberia on rd. to Zaragoza from San Antonio de Pena Nevada, broad valley, ca. 2500 m, area of oak & aspen at the bottom (N-facing margin) & agave-scrub on SW-facing slope, *Grindelia* around aspen grove, scattered but common at base of the slope in deep soil, 26 Aug. 1989, *G. L. Nesom 7149 with M. Carranza, J. Norris & J. Villarreal* (holotype, TEX [barcode] 00373597!; isotypes, ANSM not seen, MEXU-592176 digital image!). Figure 18.

Perennial subshrubs, 0.3–0.5 m, with xylopodium; stems 5 to 8, erect, ramified, glabrous or with scattered simple hairs. Leaves subcoriaceous to herbaceous, sessile; blade apex obtuse, margin serrate, teeth ending in a sclerotic tip, with dense sessile glandular trichomes on both surfaces, scarce simple hairs and minutely stipitate glandular trichomes; basal leaves obovate, 5–8 cm, attenuate into the pseudopetiole; cauline leaves, oblong-elliptic to oblong, 1.5–3 × 0.5–0.9 cm, clasping, somewhat auriculate, the uppermost sometimes acute at the apex. Heads radiate, pedunculate, 1.3–1.5 cm diam.;

involucre hemispheric-campanulate, resinous, 6–10 × 10–15 mm; phyllaries in 3 or 4 unequal series, strongly graduated, subulate, linear-elliptic, 5–9 mm, spreading, apex flat, erect or reflexed. Ray florets 20 to 31; tube glabrous, ligule narrowly elliptic, 10–11 mm, apex entire. Disk florets with corolla 5–6 mm, with an abruptly ampliate throat. Achenes brown, elliptic, 4-angled, slightly flattened, 3–5 mm, slightly longitudinally rugose, barely tuberculate, apex truncate; pappus of 2 setiform awns, 4–5 mm, barbellate. Chromosome number not known.

Distribution and habitat. *Grindelia villarrealii* has been collected from areas with oak, poplar, and *Agave* L., at ca. 2500 m, in Nuevo León (Mexico).

Phenology. *Grindelia villarrealii* has been collected in August.

Etymology. *Grindelia villarrealii* was named in honor of José Ángel Villarreal Quintanilla (1956–), curator of ANSM.

Discussion. *Grindelia villarrealii* is known only through the type collection. Its heads are small, no more than 1.5 cm in diameter, and radiate, with subulate phyllaries in strongly graduated, three or four series. The marginal teeth of the leaves end in a sclerotic tip, and both blade surfaces present dense, sessile glandular trichomes, with scattered simple hairs and minute, stipitate glandular trichomes. The taxon is close to the sympatric species *G. turneri* but differs by the marginal teeth of the leaves, the phyllaries, and the pappus awns (see Discussion under *G. turneri* above).

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APPENDIX 1. Index to collectors. Each specimen is cited by the last name of the first collector when there is more than one collector. The species number in parentheses refers to the number of the species in the text and the List of Species below.

LIST OF SPECIES

1. *Grindelia adenodonta* (Steyer.) G. L. Nesom
2. *Grindelia arizonica* A. Gray
3. *Grindelia camporum* Greene
4. *Grindelia confusa* Steyer.
5. *Grindelia decumbens* Greene
6. *Grindelia fastigiata* Greene
- 6a. *Grindelia fastigiata* Greene var. *fastigiata*
- 6b. *Grindelia fastigiata* Greene var. *revoluta* (Steyer.) Adr. Bartoli & Tortosa
7. *Grindelia fraxinipratensis* Reveal & Beatley
8. *Grindelia grandiflora* Hook.
9. *Grindelia greenmanii* Steyer.
10. *Grindelia hallii* Steyer.
11. *Grindelia havardii* Steyer.
12. *Grindelia hintoniorum* G. L. Nesom
13. *Grindelia hirsutula* Hook. & Arn.
14. *Grindelia hirtella* (B. L. Rob. & Greenm.) Adr. Bartoli & Tortosa
15. *Grindelia humilis* Hook. & Arn.
- 15a. *Grindelia humilis* Hook. & Arn. var. *humilis*
- 15b. *Grindelia humilis* Hook. & Arn. var. *platyphylla* (Greene) Adr. Bartoli & Tortosa
16. *Grindelia integrifolia* DC.

- 16a. *Grindelia integrifolia* DC. f. *integrifolia*
- 16b. *Grindelia integrifolia* DC. f. *dentata* Steyer.
17. *Grindelia inuloides* Willd.
- 17a. *Grindelia inuloides* Willd. var. *inuloides*
- 17b. *Grindelia inuloides* Willd. var. *glandulosa* (Greenm.) Steyer.
- 17c. *Grindelia inuloides* Willd. var. *latamplexa* G. L. Nesom
18. *Grindelia laciniata* Rydb.
19. *Grindelia lanceolata* Nutt.
- 19a. *Grindelia lanceolata* Nutt. var. *lanceolata*
- 19b. *Grindelia lanceolata* Nutt. var. *greenei* (Steyer.) G. L. Nesom
- 19c. *Grindelia lanceolata* Nutt. var. *subincisa* (Greene) Adr. Bartoli & Tortosa
- 19d. *Grindelia lanceolata* Nutt. var. *texana* (Scheele) Shinn.
20. *Grindelia leptocarpa* (De Jong & Beaman) Adr. Bartoli & Tortosa
21. *Grindelia macvaughii* G. L. Nesom
22. *Grindelia microcephala* DC.
23. *Grindelia nana* Nutt.
- 23a. *Grindelia nana* Nutt. var. *nana*
- 23b. *Grindelia nana* Nutt. var. *columbiana* Piper
24. *Grindelia nelsonii* Steyer.
25. *Grindelia oaxacana* G. L. Nesom
26. *Grindelia obovatifolia* S. F. Blake
27. *Grindelia oolepis* S. F. Blake
28. *Grindelia oxylepis* Greene
29. *Grindelia palmeri* Steyer.
30. *Grindelia paysonorum* H. St. John
31. *Grindelia pusilla* (Steyer.) G. L. Nesom
32. *Grindelia robinsonii* Steyer.
33. *Grindelia scabra* Greene
34. *Grindelia squarrosa* (Pursh) Dunal
- 34a. *Grindelia squarrosa* (Pursh) Dunal var. *squarrosa*
- 34a(1). *Grindelia squarrosa* (Pursh) Dunal f. *squarrosa*
- 34a(2). *Grindelia squarrosa* (Pursh) Dunal f. *pseudopinatifida* (D. Löve & J.-P. Bernard) Adr. Bartoli & Tortosa
- 34b. *Grindelia squarrosa* (Pursh) Dunal var. *eligulata* (Steyer.) Adr. Bartoli & Tortosa
- 34c. *Grindelia squarrosa* (Pursh) Dunal var. *nuda* (Alph. Wood) A. Gray
35. *Grindelia subalpina* Greene
36. *Grindelia subdecurrens* DC.
37. *Grindelia sublanuginosa* Steyer.
38. *Grindelia tenella* Steyer.
39. *Grindelia tricuspis* (Sch. Bip.) Adr. Bartoli & Tortosa
40. *Grindelia turneri* G. L. Nesom
41. *Grindelia villarrealii* G. L. Nesom

Abrams L. 3957 (10); Alexander A. M. 3712 (15a); Ammerman E. s.n. (22); Anderson G. R. s.n. (15a); Arredondo D. G. 227 (28); Arsène Fr. G. 101 (38).
Baird C. 1397 (23b); Baker C. F. 497 (5), 538 (2), 526 (34c), 682 (2), 683 (19c), 1701 (3), s.n. (34a1); Barriga H. D.

2492 (17a); Bartram E. B. s.n. (15a); Beatley J. s.n. (7), s.n. (7); Berlandier J. L. 766 (38); 2057 (22); Bernard J. P. 58/263 (34a2), 58/510 (34a2); Bioletti F. T. s.n. (3); Biology class 9014 (34c); Blankinship J. W. s.n. (23a); Blumer J. C. 4 (33); Bolander H. N. 389 (13), 6493 (15b); Botany Beechey's Voyage s.n. (13), s.n. (15); Bradley A. 477 (16a); Brandegee K. s.n. (15b); Breedlove D. E. 59348 (29), 63552 (9); Breitung A. J. 5676 (34a1); Bremer K. 2325 (31); Brewer W. H. 850 (3); Brown H. E. 599 (23a); Brown O. H. s.n. (34a1); Brunsfeld S. J. 79438 (30); Burch D. 5139 (29); Burt Davy J. 1383 (15a), s.n. (15a); Bush B. F. 220 (19a); Bush R. J. s.n. (34a1).

Candolle A. de s.n. (16); Canne-Hilliker J. M. 1941 (17c); Carter J. L. 1961 (34a1); Chandler H. P. 5460 (10); Chas C. D. 36 (34a1); Chase V. H. 7266 (32), 7376 1/2 (32), 7578 (38); Chiang F. 9170 (19d); Chittenden E. M. 104 (9); Christ J. H. 11478 (23a); Clemens J. 948 (1); Clokey I. W. 4323 (6a), 4324 (6a); Collom R. E. 463 (2); Colwell A. 85 (16a); Congdon J. W. s.n. (15a); Correll D. S. 20165 (4), 30251 (34c); Cory V. L. 5013 (8), 40706 (8), 50544 (8), 51421 (27), 52450 (8); Cotton J. S. 780 (23b); Cowen J. M. s.n. (34a1); Craig C. F. 1774 (6b); Cronquist A. 9759 (29), 9811 (39).

Demaree D. 9235a (15b), 10248 (3), 10424 (13), 10469 (3), 10522a (3), 10523 (13), 13192 (19d); Davidson A. 736 (2); De Jong D. C. D. 971 (20); Díaz Luna C. L. 2533 (36), 13168 (17a); Diwart F. M. s.n. (19a); Douglas D. 55 (13); Dreisbach R. R. 6967 (34a1); Drushel J. A. s.n. (6a); Duke J. A. 3974 (38); Dunford M. P. 1156 (27), 1157 (8), 1173 (6a).

Earle F. S. 509 (11); Eastwood A. 63 (6a), 280 (13), 794 (15b), s.n. (13); Edwin B P. 1883 (30); Eggert H. s.n. (8); Elmer A. D. E. 4267 (13); Encina J. A. 821 (8), 826 (8); Engelmann G. 650 (34a1), s.n. (34c); Ertter B. 10142 (13); Escobedo J. M. 2509 (17a); Eyerdam W. J. 1150 (15a), 1179 (15a), 1302 (15a), s.n. (15a), s.n. (15a).

Fernald M. L. 1078 (34a1); Fernández R. 4834 (17a); Ferris R. S. 3391 (34c); Finch A. 6 (34c); Findlay W. s.n. (34a1); Fisher L. 37145 (32), 44165 (28); Fogg J. M. Jr. 22274 (34a1); Franklin B. 4350 (6a); Freeman C. C. 2041 (34b), 2054 (34b), 2056 (40), 2137 (33); Friberg G. N. s.n. (15a).

Galván R. 3566 (36); Garza F. 4265 (9); Gates F. C. 14967 (34a1), 18989 (34a1); Ginzburg S. 180 (9); González-Martínez 102 (14); Goodman G. J. 765 (35), 2321 (34c), 3290 (34a1); Gorman s.n. (15a); Grant J. M. s.n. (15a); Green P. B. 274 (35); Greene E. L. 974 (23a), s.n. (3), s.n. (5), s.n. (6), s.n. (6a), s.n. (13), s.n. (15a), s.n. (15a), s.n. (15a), s.n. (15b), s.n. (35), s.n. (35); Gregg J. 97 (34b), 354 (34b), 444 (28), 627 (28), s.n. (34b); Grimes J. 2278 (40); Guevara E. s.n. (4); Gutiérrez R. s.n. (17a); Gutierrez S. 1 (17a); Guzmán R. 953 (17a).

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Thompson J. W. 4745 (23a), 4945 (23a), 7164 (23b), 7855 (15a), 9959 (15a), 10091 (15a), 11119 (23b), 17376 (23a); Tracy J. P. 4669 (23a); Trelease W. s.n. (19a); Turner B. L. 76-13 (17c), 15329 (17a).

Umbach L. M. s.n. (23b).

Van der Werff H. 6058 (10), 8707 (10); Ventura P. 15435 (17a); Villarreal J. A. 2312 (28), 2351 (26); Visher S. S. 3360 (34a1).

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